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## Contents

Survey of Operations and Finances of Scientific Journals: <i>Robert Tumbleson and Helen L. Brownson</i> .....	357
A New Experimental Animal for Psychiatric Research: The Opossum, <i>Didelphis virginiana</i> : <i>William S. Wiedorn</i> .....	360
The Principal Characteristics of the Formation of the Earth's Crust: <i>W. S. Jardevsky</i> .....	361
Samuel Clark Harvey: 1886-1953: <i>Harry S. N. Greene</i> .....	365
Albert Sterling Eisenstein: 1918-1953: <i>Newell S. Gingrich</i> .....	366
Joseph Oscar Wilhelm: 1899-1953: <i>W. J. Mackey</i> .....	367

## News and Notes

High Polymer Chemistry; American Institute of Electrical Engineers; and Regular Departments .....	367
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## Technical Papers

Oxygen Protection against Ionizing Radiations: <i>C. S. Bachofer</i> and <i>M. Aelred Pottinger</i> .....	378
Adrenocorticotrophic Activity of Nonmammalian Origin: <i>John W. Nelson, Paul W. O'Connell, and William J. Haines</i> .....	379
Effect of Hypoxia on DNA Synthesis in the Bone Marrow and Spleen of the Rat: <i>W. A. Rambach, J. A. D. Cooper, and H. L. Alt</i> .....	380
Detection of Microbially Produced Gaseous Hydrocarbons Other than Methane: <i>John B. Davis and Rodney M. Squires</i> .....	381
The Quantification of Hostility in Dreams with Reference to Essential Hypertension: <i>Leon Saul et al.</i> .....	382
The Effectiveness of 2,4,5-Trichlorophenoxyacetic Acid in Reducing Drop and Promoting Growth of Frosted Apricot Fruits: <i>Julian C. Crane</i> .....	383

## Communications

Air-Borne <i>Histoplasma capsulatum</i> Spores: <i>Roland Books</i> .....	385
Cancer Research at a Marine Laboratory: <i>C. M. Breder, Jr.</i> .....	386
The Hayward Fault of California at Its Type Locality: <i>G. D. Robinson</i> .....	386
Kaolin of Early Eocene Age in North Dakota: <i>William E. Benson</i> .....	387
<i>Spirodiscus</i> Ehrenberg Identified as <i>Ophiocytium</i> Nügli: <i>Herbert F. Copeland</i> .....	388
Basaltic Magma at Hawaii Is Saturated in Silica: <i>H. A. Powers</i> .....	388
The Helicopter and the Walkie-Talkie in Field Surveys: <i>John B. Rowland</i> .....	389
Sex Ratio and Fruit Setting in Mango: <i>E. N. Singh</i> .....	389
Extensions in Geographic Range or Lack of Data? <i>Paul Knight</i> .....	390
Mechanism of Suppression of Hemagglutinating Viruses: <i>E. D. Barnard, B. Goldman, and H. T. Stanton, Jr.</i> .....	391

## Book Reviews

Association Affairs—The American Dental Association .....	394
Shall All International Congresses Be Held Abroad? .....	3A
Meetings & Conferences .....	14A-18A

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# Survey of Operations and Finances of Scientific Journals

Robert Tumbleson and Helen L. Brownson

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THE SKY-ROCKETING volume of original scientific publication and the publishing cost, which has increased even more rapidly, have created critical financial problems for some scientific journals and have been of serious concern to all. The volume of publication continues to rise. In 1951 the total number of pages in journals published by the American Institute of Physics rose 7 per cent over the previous year. The publications of the American Chemical Society report comparable increases.

Part of this rising flood of words can be considered "normal" in that the number of scientists is larger than ever before, and hence a greater output can be expected. Of still more significance is the fact that a larger proportion of scientific man-years is being drawn into research and development work because of unprecedented amounts of support for such work. Estimates of the Research and Development Board, Department of Defense, indicate that total expenditures for research and development have increased from \$900 million in 1942 to \$2900 million in 1952. The industrial contribution has gone from \$500 million to \$1200 million in this ten-year period while that of the federal government increased from \$300 million to \$1600 million. The university contribution has doubled—from \$50 million to \$100 million in the same period.

Aware of the critical nature of the problems facing the journals, the National Research Council, in February 1950, called a Conference on Primary Publication attended by representatives of many journals, scientific societies, publishing houses, and government agencies. Many ideas for reducing costs and increasing revenues were discussed. Some of these had proved highly useful in individual cases, but it was difficult to gain a clear-cut picture concerning the overall state of scientific journal publication.

In its basic legislation the National Science Foundation is authorized and directed to encourage the dissemination of scientific information. Because journals of primary publication represent a most important channel in this process, the Foundation, shortly after it was organized, began to compile data on the current status of journals. During the course of this investigation a questionnaire was distributed to a selected list of journals. It was designed to obtain facts concerning circulation, volume of original research papers published and the backlog awaiting publica-

tion, sources of revenue, and expense items. In addition, opinion was sought regarding appropriate or potential sources of additional support and the purposes for which additional funds were needed. A final question asked about the policies of journals with respect to publication levies to be paid by authors or institutions sponsoring research. This was of particular interest to a number of federal agencies that found it difficult to pay such charges when assessed against scientists in their employ or in the employ of their contractors. However, a recent decision by the Comptroller General of the United States (B-114593, May 1953) appears, in the case of most agencies, to have removed legal obstacles to the payment of part of the cost of disseminating the results of research through private scientific journals.

One hundred ten, or 54 per cent, of the two hundred five questionnaires distributed by the Foundation in this survey were returned. The response varied widely from field to field. For example, seven out of eight (88%) of the questionnaires sent to geological journals were returned, whereas only fourteen out of forty (35%) were returned in engineering. No data are included about the journals of the American Medical Association or the American Chemical Society. The circulation of journals answering the questionnaire ranged from less than 500 to more than 60,000; the average circulation was about 6000.

Approximately 71 per cent of all replies returned were from official journals of scientific societies, and about 58 per cent of subscribers in this group were society members. Approximately 50 per cent of subscribers, to journals having a circulation of 4000 or less were member subscribers, compared to 68 per cent for journals with circulations over 4000. This seems to indicate that the nonmember audience, largely institutional, for scientific periodicals is relatively fixed and that circulation depends largely on membership support, an important factor in the economics of journal publication.

On the average, this group of journals published about 900 pages of original research material annually, ranging from less than 100 pages to more than 5000 pages. Approximately seventy per cent of all papers submitted to editors are eventually published in the journals to which submitted. A considerable proportion of the remainder are turned down because they are submitted to the wrong journal.

Seventy of the one hundred journals reported a backlog of accepted but unpublished articles of less than six months; twenty-five journals had a backlog of from six months to one year, and five of a year or longer. The average backlog was 5.3 months for journals publishing five hundred pages or less per year and 1.9 months for journals publishing over 2000 pages per year.

There was also a negative correlation between the extent of the backlog in months and length of articles. The backlog was 5.6 months for journals in which the average article ran four pages or less compared to 2.1 months for journals in which the average article length was twenty pages or more. The time-consuming process of revising articles to meet space limitations may be revealed in these figures.

The replies did not indicate that a "tight" or "loose" referee policy as measured by the proportion of papers accepted had any effect on the backlog.

One section of the questionnaire was devoted to journal finances. The answers revealed considerable differences in accounting methods, particularly in connection with the distribution of costs. Cost information for eighty-two journals is summarized in Table 1.

The low editorial cost item for journals having less than 1000 circulation may be explained by the fact that the editors are in large part volunteer workers and editorial clerical help is frequently contributed by the institution employing the editor. As expected, composition is the largest production item for journals of small circulation, whereas cost of paper and presswork is more important for journals of larger circulation.

Information on the sources of present support for publications is summarized in Table 2 and shows the proportions of income received from various sources. This breakdown varies widely with circulation. Two-thirds of the income received by journals having less than 1000 subscribers comes from sale of subscriptions and society contributions in lieu of member subscriptions. This falls to 45 per cent for journals having circulations of 8000 or more. The journals with small circulations receive insignificant revenues from advertising, but in the case of journals having circula-

TABLE 2. Sources of income of scientific publications.

Source of income	Circulation (%)		
	Less than 1000	1000 to 7999	Over 8000
Subscriptions and society contribution in lieu of subscriptions	67.2	69.8	45.2
Other sales income	12.1	5.1	0.8
Reprint income and payments from authors	16.0	7.0	2.5
Advertising revenue	0.7	14.2	51.5
Support from private foundations	2.3	3.2	—
Other	1.7	0.7	—
Total, all sources	100.0	100.0	100.0

tions of 8000 or more, advertising revenue makes up more than half of the total income. In the table, income from sale of reprints and author contributions are lumped together, as the authors or their institutions normally are the largest purchasers of reprints.

Respondents were asked where they believed additional financial support could most appropriately be obtained. Forty-six editors out of ninety-four who answered suggested "more advertising" as a source of additional revenue. Editors of smaller journals realize that this is an unlikely source of funds, however, since only 23 per cent of the editors of journals with a circulation of 1000 or less checked this as against 51 per cent for journals having circulations of 1000 to 7999, and 82 per cent for journals with circulations of 8000 or more.

About half of the replies suggested that additional support should be obtained from a society or private foundation or both. Only one out of six thought direct support from the government desirable, and only one out of eight proposed direct support from industry, other than advertising.

Slightly fewer than one-third suggested "higher subscription rates" as a possible source of additional income, 20 per cent checked "higher reprint charges," and 28 per cent proposed a page charge to be paid by the author or institution supporting the research. Seventeen out of ninety-four editors (18%) proposed consolidation of related journals as a potential source of added income or reduced costs.

Thirty-six of the ninety-four replies suggested that further editorial or production economies could be achieved; twenty-five of the thirty-six proposed shorter articles as a specific method for doing this. Opinion on the desirability of running shorter articles varied significantly with the length of articles now appearing in the respondents' journals. Thirty-five per cent of the replies from journals in which articles now average less than ten pages in length proposed shorter articles, compared to only 13 per cent for journals running articles of ten pages or more.

About 30 per cent of the replies checked "better promotion" as a method for increasing income. This varied with circulation: 8 per cent in the case of jour-

TABLE 1. Distribution of costs for scientific publications.

Cost item	Circulation (%)		
	Less than 1000	1000 to 7999	Over 8000
Editorial expense	1.9	10.9	10.8
Administrative overhead	16.2	12.1	7.5
Composition and engraving	60.6	30.1	24.7
Printing and binding	10.9	19.0	13.7
Paper	7.1	10.7	18.8
Mailing	1.1	4.1	8.2
Circulation promotion	0.1	1.3	1.9
Advertising promotion	—	1.3	6.2
Other	0.7	3.0	5.8
Surplus	1.5	7.4	2.5
Total	100.0	100.0	100.0

nals having less than 1000 subscribers, 31 per cent for those having more than 1000 but less than 8000, and 45 per cent for those having 8000 or more.

A question was added to the questionnaire asking about the effect of lack of funds upon the scientific usefulness of the journal. Replies were compared with reported data on number of pages, length of article, backlog, and percentage of acceptances. No meaningful relationships could be discovered. For example, some of the editors who indicated that financial difficulties had had no effect upon the scientific usefulness of their journals reported backlogs of unpublished articles ranging from ten to twenty-one months, while the editors who indicated that the scientific usefulness had been seriously impaired by lack of funds reported backlogs of 3.6 to 6.4 months. Other factors were equally difficult to interpret.

The questionnaire asked about the use to which editors would put additional funds if available. Eighty-four per cent of all replies to this question indicated that additional funds would be used for additional pages; 43 per cent would use additional funds to increase the speed of publication; and about 30 per cent for the publication of longer articles. Half of the editors would use additional funds for improved editorial help and about one-fourth for improved format.

The pattern of response was interesting. The desire for better editorial help increased with circulation—from 14 per cent for journals having a circulation of less than 1000 to 77 per cent for journals of 8000 or more subscribers. A trend in the opposite direction was true among those desiring more funds to increase the speed of publication—71 per cent for small circulation journals and 23 per cent for large circulation journals.

Approximately 40 per cent of the journals accepting 70 per cent or more of submitted papers would use additional funds for longer articles, compared with only 15 per cent for journals having a higher turn-down rate.

Sixteen journals in the group surveyed now require payment of a publication fee by the author or his institution based upon the number of pages printed. An additional eleven journals require payment for excess pages on very long articles, and twenty-six journals require payment for plates and tables. In two or three cases payment is not required normally, but if the author assumes publication costs his article appears immediately.

The author or institution is generally billed at the time of publication, but in some instances a less direct system is employed. The American Mathematical Society, for example, utilizes a system of institutional members whose dues are based upon the average number of published pages originating in the institution in previous years.

Eleven of the sixteen journals which make publication charges gave an analysis of revenues so that it

is possible to estimate the proportion of total income received from authors or institutions supporting research. The income breakdown for these journals is as follows: subscriptions and society contributions in lieu of subscriptions, 69.5 per cent; other sales income, 6.0 per cent; reprint income, 3.6 per cent; payments from authors, 12.4 per cent; advertising revenue, 5.7 per cent; other 2.9 per cent.

Thus, about one dollar out of eight of total revenues is derived from publication charges. One journal obtains 34 per cent of its revenue in this way, 6 from 10 to 19 per cent, and the remaining 4 receive less than 10 per cent.

The Foundation also distributed a brief questionnaire to a number of industrial laboratories and research institutions and private research foundations to learn their policies regarding payment of publication charges. Eight of the twelve industrial laboratories and institutes pay such charges if requested. The remaining four have apparently received no requests for payment; one expressed opposition to payment, and one appeared willing to consider such assistance to the journals if it were shown to be needed. Four of the eight private foundations queried now pay such charges upon request. The remainder have had no requests for payment, although one indicated it would probably be willing to pay such charges if asked. All twelve of the industrial laboratories and institutes and three of the foundations buy reprints; eight of the industrial group buy advertising and six maintain institutional society memberships.

As mentioned above, 26 replies out of 94 approved a publication charge as an appropriate method for increasing journal revenues. Of these, seven now make such a charge, nine charge for excess pages or plates, and ten make no charges of any kind. It is interesting to note that more than half of the journals which make a publication charge did not list this as a possible method for increasing income.

In summary, then, it would appear that the scientific journals covered by the survey are managing to publish most of the material submitted within a reasonable period. On the whole, editors dislike the idea of direct subsidy from any source, including the federal government. Although one out of four believes that a publication charge is an appropriate method for getting funds, a considerably larger proportion believe that additional income should be obtained from the society membership or industrial advertising.

The comments made by many of the editors were revealing and brought out additional points that the questionnaire overlooked. In particular, several editors called attention to the large number of articles that are badly written, repetitious, over long, and in which the presentation of scientific material was confused even where reported results and techniques appear to be sound. This creates difficult editorial problems and contributes to the cost and delay in publication.



# A New Experimental Animal for Psychiatric Research: The Opossum, *Didelphis virginiana*

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THE opossum, *Didelphis virginiana*, is a commonly occurring native marsupial. Opossums are easily handled and maintained in captivity. The opossum has received wide use in endocrinological, embryological, anatomical, and neurological research, but has received no attention as a valuable experimental animal in psychiatric research. The opossum spontaneously exhibits a catatonic-like response to threatening stressful stimuli. The components of this response are seen in the total performance of the opossum and also in the central nervous, autonomic nervous, gastrointestinal, cardiac, respiratory, urogenital, somatic muscular, and special sensory systems.

Exposure of the opossum to a threatening stressful situation initiates the following sequence, in which all the components are present to a greater or lesser degree, depending upon the individual animal and its previous experience. First there is exaggerated, if not inefficient, somatic muscular action in an attempt to escape, with some of the animals making a low growling sound and snapping. This initial and not invariably present phase of hyperactivity is marked by a rapid heart rate, increased rate and depth of respiration, defecation, occasionally urination, extrusion of a foul smelling yellow green material in a fine spray from the perianal region, periorbital muscle tension, and a drawing back of the angles of the mouth. The initial hyperactive phase is of short duration, from a few seconds to five to ten minutes. This hyperactive phase is often so transitory as to be almost absent.

In the second or catatonic phase, the animal becomes semirigid and usually assumes a posture of lying on one side with the limbs partially extended, the mouth open, and the tongue slightly protruded. The limbs may be flaccid or rigid at various times while the animal is in this catatonic-like state. The heart rate is decreased and the apical impulse is often impalpable. The respiratory movements are slowed and predominantly abdominal. Frequently they are so slight that the abdominal or thoracic movements cannot be detected. Following periods of stimulation or stress, while in the catatonic state, the opossum may exhibit periods of apnea for 30 sec or more. There is greatly increased salivation, with a pool of watery saliva forming about the animal's mouth. The mucous membranes become pale and dry. The animal may continue to defecate while in this state, each succeeding stool becoming more watery. The tendon reflexes are usually absent, as is sometimes the corneal reflex. The cremaster reflex has invariably been present. In the latter

part of the initial hyperactive phase and the early part of the retarded catatonic phase, the eyes may show rapid lateral nystagmoid movements; the limbs may show a rapid and gross tremor, most marked in the hind limbs. If held up by the skin of the dorsum of the neck during this period, the animal assumes a posture with the mouth agape, the tongue protruded, the forepaws clenched together, and the hind limbs extended laterally with gross muscle tremor. The eyes do not close, although the lids may move close together. During the catatonic-like state, the animals do not respond to painful forced flexion of the fingers, rough bodily manipulation, tactile stimulation, irritation of the nasal vibrissae, and stroking of the cornea.

The opossum may show both active and passive negativism, as described in the criteria of animal catatonia of deJong (1). In a long catatonic state the animal may respond to auditory stimuli, especially if the sound is loud, low-pitched, and sudden. Olfactory awareness, as evidenced by wriggling of the external nares, often persists while the animal is in the catatonic-like state.

At any time, depending upon as yet unknown intra-organismic factors, the opossum may suddenly reintegrate and make attempts to escape. This is most likely if the animal is suddenly exposed to a new and major stimulus. The opossum also may gradually reintegrate when placed back in the safety of its cage, but diminished awareness may persist for an hour or more.

The animals may remain in the catatonic-like state for as long as 2 to 6 hr, or only for several minutes. In their cages the opossums may show immobility in an abnormal position for many hours after being stressed. This state may even be induced repeatedly in the same animal on the same day, with longer or shorter periods of catatonia. However, the opossum becomes less likely to exhibit the catatonic-like response as it gains experience with either a particular stress situation or a particular experimenter.

The value of the opossum as an experimental animal in psychiatry lies in the fact that it spontaneously exhibits a catatonic-like syndrome which illustrates all the concomitants of the catatonic syndrome seen in man in psychopathologic conditions. Not only do these states occur spontaneously in the opossum, but they also may be induced with test stressful situations with quantification of total performance of the organism and evaluation of component system changes. The opossum experiences this state in the absence of the administration of pharmacologic catatonia-inducing

agents (such as bulbocapnine or mescaline), and thus avoids the contamination of the experimental situation from both the performance and the physiologic point of view. The opossum is also characterized by a primitive, "olfactory," nervous system with rudimentary neopallial structures, thus lending itself to experimentation directed towards the elucidation of the

functional effect of phylogenetically old structures in the mammalian brain.

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## The Principal Characteristics of the Formation of the Earth's Crust

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AS THE QUESTION of the shape of the earth was a much disputed one several hundred years ago, so is today the question of its surface pattern. But while celestial mechanics has provided ample explanation for the gross appearance of our planet, the majority of contemporary geologists and geophysicists are still in want of a mechanism that would account for the principal characteristics of its crust. Many attempts have been made to explain different formations by assuming processes peculiar to a given case, but there has been little success in the efforts to harmonize this multiplicity of proposed mechanisms and to give a unified physical picture of the history of the outer shell of the earth. Yet a careful look at a physical map will reveal certain regularities in the structure and distribution of the continents, oceans, and mountain chains, and will lead one to believe that, although the existence of a multiplicity of particular mechanisms is unquestionable, there must have existed a dominant process exerting a determining influence on the formation of the principal features of the terrestrial surface.

Various processes have been ascribed such a dominant role. Of the more important ones, the shrinking of the planet, the separation of the moon, and the migration of continents (1, 2) should be mentioned. The first two processes seem far from furnishing a satisfactory explanation for many prominent features of the earth's surface pattern. As to the third one, a large amount of material in the field of geology and related sciences has been gathered by Wegener (2) to substantiate the hypothesis. However, despite the fact that a large part of the data appears to be in perfect agreement with this hypothesis, it has failed to gain general acceptance, largely because it does not provide for the mechanism that would satisfactorily explain the relative displacement of continents. If we are to decide on a process as playing a dominant part in the formation of the earth's crust, we ought to choose one that would best agree with the principal characteristics of this formation and for which a plausible mechanism could be established.

As a first step, then, an attempt has to be made to collect those characteristics of the formation of the earth's crust that could be regarded as the principal ones. Failure in the past to differentiate between the chief and the secondary features, as well as limiting the considerations to the findings of but one discipline, has led to the formulation of theories that can often be applied only to a very restricted number of data, although they appear plausible when taken by themselves. Later we shall consider a mechanical concept that suggests itself from our findings as a suitable explanation for all of the enumerated characteristics.

*Astronomy* has shown that the nearly spherical shape of the earth is not an exceptional phenomenon. This shape differs but little from one of several well-known figures of equilibrium for a fluid mass that is isolated in space. Thus, the assumption that the earth once was in a fluid state became a highly probable one. As with every liquid celestial body, it should have been covered by a crust in the process of cooling. This crust would take the form of a spherical shell if there were no rotation. In case a slow rotation should take place, the crust would become an ellipsoidal shell of small ellipticity. The earth, however, being a member of the solar system, was never an isolated mass. Its path in space during the three billion years of its history was a very complicated one, owing to the existence of external forces such as the attractions exerted by other members of the solar system. This fact makes impossible any situation that would correspond to the exact conditions of equilibrium. Even now, when a larger part of the body of the earth seems to be solidified, tidal deformations in the crust produced by the moon and sun are considerable.

However, external gravitational forces are not the only factor disturbing the mechanical equilibrium of the earth. In fact, there is no trace of mechanical equilibrium in any known fluid celestial body. Such a state is sometimes assumed, but only in order to simplify a theory. In the process of cooling, a temperature gradient is set up between the surface of a celestial body and its interior. Thermal equilibrium becomes

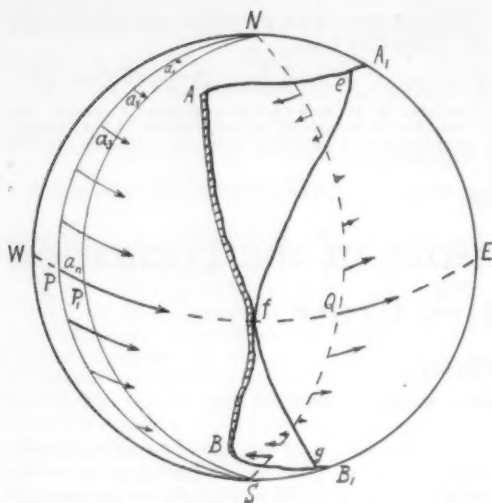


FIG. 1. A zonal distribution of velocities in a liquid substratum is shown by the arrows  $a_1, a_2, \dots, a_n$ , which represent the components along the parallels, increasing toward the equator. The meridional components should have directions  $NP$  and  $SP$ . The arrows along  $NQS$  correspond to tangential stresses at the inner surface of the block  $AB$ ; this block can burst along the line  $efg$ .

impossible even in gravitationally stable layers (3), and convection currents thus become a highly probable phenomenon in a fluid celestial body (4). It was pointed out that these currents could maintain a rotation-pattern different from that of a rigid body against the increasing viscosity (5, 6). Such a nonuniform rotation of celestial bodies is a well-known fact. At least three fluid members of the solar system (sun, Jupiter, and Saturn) manifest at the present time an unequal distribution of angular velocities characterized by an acceleration of the equatorial belt with respect to other parts of the mass. This situation is represented in Fig. 1 by the set of arrows,  $a_1, a_2, \dots, a_n$ , displacements being proportional to the lengths of the arrow. The difference from the case of a rigid planet can be easily appreciated when one considers that in the latter, the particles undergo the same displacements as do the points of the meridian  $NPS$  (Fig. 1).

Thus, the principal characteristics of the formation of the earth's crust suggested by known astronomical facts could be the following: (a) lack of any kind of equilibrium in the outer layer of the earth when it was in a liquid state; (b) deformations of this layer in the liquid and solid states by tidal forces; (c) the existence of internal movements in the planet that influence the formation of the shell by stresses acting on the inner surface of the latter; and (d) a special distribution of convective currents which conceivably could be symmetrical in the two hemispheres, producing a zonal rotation of the planet.

To this group of astronomical characteristics must be added those facts that have been established in the sciences of the earth. *Geodesy* confirms once more that the figure of the earth differs but little from a slightly compressed ellipsoid. Thus, the progressing consolidation of our planet did not change its shape essentially, the irregularities of its surface being very small in comparison with its size. *Geography* yields the well-known descriptive material, and it should be borne in mind that every theory of the formation of the earth's crust has to explain this actual distribution of principal features, that is, the shape and position of existing continents, oceans, and mountain ranges. As simple and natural as this statement is, one finds it only too often neglected. One of the most important characteristics is the existence of the so-called geographic similitudes, which cannot be disregarded, as it frequently has been. The congruence of the opposite coasts of South America and Africa, which for a long time has attracted the attention of investigators, and the existence of the Mid-Atlantic ridge, which is stretched out on the midway between the New and Old World, are perhaps the most striking examples. Thus, we have to keep in mind these geodesic and geographic features: (a) the nearly spherical shape of the shell; (b) the actual distribution of continents and oceans; and (c) the distribution of mountain ranges existing at present as well as those that existed in the past geologic periods.

Further characteristics of the structure of the earth's crust are to be found in *geology*. There does not seem to be any doubt that the following conclusions reached in geology must be considered in the first place: (a) the earth has been changing its face, that is, the crust has been subjected to many major or minor deformations; (b) the composition of continents differs from that of ocean basins; (c) the continents themselves are not uniform in composition; there is a smaller part of each continent, the shield, that constitutes a nucleus, around which material has been accumulating until the continent has reached its actual shape and size; (d) certain parts of continents came to form sea bottoms at different geologic periods and were covered by layers of sediments; (e) by epeirogenic and orogenic processes, some parts of continents were raised and some folded; (f) the major folding processes, giving rise to the principal mountain ranges, were followed by intensive intrusions; the distribution of batholiths indicates that these could have been masses of molten magma which raised the overlying solid layers and probably melted part of the solid matter with which they came into contact; (g) the formation of mountain chains has been shown to have had a cyclic character; more precisely, there were geologic revolutions each comprised of several phases and separated from the preceding and following revolutions by time intervals of variable duration, during which no folding occurred on a larger scale.

Insight into the structure and properties of the deeper parts of the continents or of the ocean basins has been gained largely by students of *geophysics*.

Among many characteristics established with a good degree of certainty in this science are these: (a) the continental and suboceanic parts of the crust differ in composition; (b) the core of the earth displays, even at the present time, certain properties of a liquid; (c) the distribution of densities in the crust corresponds more or less exactly to the state of isostasy, which shows that there is a continuous adjustment of masses to the conditions of equilibrium for floating bodies; and (d) the existence of such deformations in the earth's crust suggests a certain plasticity of the material forming it, even at present.

These various statements, mentioned here as principal characteristics, are either facts established directly by observation or assumptions based on well-known facts. The question arises whether these are all the characteristics that should be taken into account in the first place. We always have to be aware that such a list can never be considered as definitely completed. The history of science abounds with examples of changes in the estimation of importance of certain facts. Nevertheless, it seems to the author that even the list so far presented makes it possible to start a systematic summary of that part of the history of the earth which refers to the formation of the crust. The list of assumptions will take a more precise and complete form as more of an agreement is reached about this process.

Such a systematic summary is attempted in the following with the hope that it will be of help in reaching an understanding of the principal mechanism or mechanisms involved. In an effort to find forces that would be large enough to account for displacements of such gigantic proportions as those of continents or those involved in the formation of mountain ranges, the author has suggested the forces due to a zonal rotation of the planet and has been able to show both theoretically and experimentally that this hypothesis will provide a plausible explanation (6-9).

The sequence of events as suggested by this hypothesis is as follows. Two or more billion years ago the earth was a fluid body of nearly spherical shape. Despite the fact that, taken as a whole, the earth had a shape differing but little from a figure of equilibrium, there was no real equilibrium. Tides and internal movements were superimposed on its rotation in a way similar to the ones observed now on fluid members of the solar system. Heated in the interior and cooled at the surface, the earth would have been subjected to two processes: (a) *the convection currents maintaining a nonuniform rotation and producing different zonal components of displacements or velocities* (Fig. 1); and (b) *the decrease in the average temperature of the outer layer after it became liquid, thus favoring the formation of solid blocks*. Because of the differentiation of material produced by the action of gravity, the density should increase with the depth. Thus, the solidified masses formed at the surface would be composed of the lighter material (sial) and would float in the outer layer. Both types of forces, namely, the tidal forces and the frictional stresses, acting on the

submerged parts of the floating blocks could hinder a "fast" formation of the crust. It can easily be seen that each of these forces favored a horizontal segregation of the sial (7, 10). Thus for a certain time interval, the formation of a large single floating block was highly probable; whenever there are many floating masses on a liquid planet moving with different velocities along the parallels, the faster ones will capture those that are moving more slowly, after several revolutions. This probably relatively short period of the history of the earth was followed by another during which the whole surface was covered by a thin shell. Such a crust could be broken into parts several times and welded again. This could provide an explanation for certain deviations from homogeneity in the uppermost layer, for example, for the existence of shields which represent the largest homogeneous parts of continents (7).

Until this point there is no definite reason for making a choice among three hypotheses, namely, among the assumptions that the formation of the present features of the earth's crust is due either (a) to the action of tidal forces, or (b) to a zonal rotation opposite to that represented by Fig. 1 (i.e., corresponding to an angular velocity increasing toward the poles), or (c) to the effect accepted by the author, which is characterized by the existence of an equatorial acceleration. Nobody has yet succeeded in providing a satisfactory explanation for the real topography on the basis of tidal forces or on the assumption of a zonal rotation characterized by polar acceleration. On the contrary, if one assumes (6), for the duration of several geologic periods, a zonal rotation of the earth following a law similar to that of Carrington-Faye, which holds for the sun,  $\omega = a + b \sin^2 \theta$ , where  $\omega$  is the angular velocity,  $\theta$  the latitude,  $a$  a positive constant, and  $b$  a negative constant, one can demonstrate that the field of forces resulting from this rotation will be able to produce deformations in the crust of the same nature as those outlined above (7). To show this, we shall briefly consider the field of forces due to the stresses at the interface crust-substratum, leaving out of consideration, for the present, the secondary effect of gravitational forces.

After solidification, the earth's crust should rotate with an angular velocity having a certain average value if compared with angular velocities in different zones of the liquid part. The equatorial belt and the polar caps of the underlying liquid layer would have the extreme values of velocity and, therefore, liquid particles would be displaced with respect to the solid block  $ABB_1A_1$  (Fig. 1) in a manner shown for one meridian,  $NQS$ . This block could represent a floating body or cover the liquid completely, that is, be a solid crust. The relative displacements of the underlying liquid (magma) must produce horizontal stresses at the inner surface of the block. Their distribution has, of course, the same zonal character; and the author has been able to show that if a solid block subjected to stresses of this kind will burst, it will do so along a line represented by the curve  $efg$  in Fig. 1 (7).

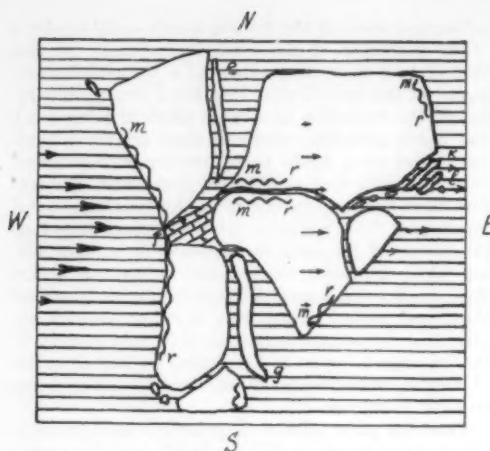


FIG. 2. The initial form of the plate broken into parts shown on this figure was similar to that of Pangea as determined by A. Wegener.

Rupture of the block may occur at several places in a similar manner. Moreover, the suboceanic parts of the crust, being subjected to similar stresses, could also be broken. If we compare the western parts of a block broken off in this way with the geographic map, we will see that these parts, *Aef* and *Bgf*, are similar to North and South America.

The author's experiments (8) concerning the rupture of thin plates subjected to superficial stresses have shown that it is possible to obtain a model of the formation of continents in this way. Stresses acting on fragile plates were produced by a substratum in which the distribution of velocities followed the law of zonal rotation. The parts resulting from the rupture of a plate turn out to be very similar in appearance to the actual continents, particularly if one also takes account of the heterogeneity of the plate. One of these broken plates, which was reinforced at places corresponding to the actual positions of shields, is shown on Fig. 2. The exact number of continents, their relative position, their shape, and even certain secondary features—such as a strip *efg* corresponding to the Mid-Atlantic ridge and many islands *kl* of "East Indies"—were obtained in this and similar experiments (7).

Thus, the author's assumption that a zonal rotation took place in the interior of the earth after the crust solidified provides a simple mechanism for the formation of continents and ocean basins that corresponds to their actual distribution. Moreover, it serves to explain certain mountain ranges and several other details of the structure of the crust. In many experiments, the whole Tertiary mountain belt, except the Himalayas, was formed at the right places, as it is shown by the several lines *mr* in Fig. 2. A little consideration shows that this folding must occur when the forces due to the assumed zonal rotation produce a pressure, for example, like that at the west side of the New World, or drag the other continents to the east

and, because of equatorial acceleration, force the northern continents to turn counterclockwise and the southern ones to turn clockwise. As to the Himalayas, one has to take into account the fact that the peninsula of India was located on the faster moving equatorial belt and, therefore, could be pressed into the continent of Asia. The last idea was suggested by Wegener and should be confirmed by a special experiment.

A part of the mountain ranges older than the Tertiary belt can be explained in the same way, but the formation of the remaining mountain ranges will become clearer when the changes in the field of internal forces are more extensively investigated. One reason for such changes can immediately be seen. The distribution of masses in the earth's crust covering a liquid core was always an asymmetric one (11). Therefore, larger displacements of the crust with respect to the "axis of rotation" of the earth were highly probable (11) and there is no doubt that such displacements would produce essential changes in the field of forces.

Even the simplified form of the hypothesis of a zonal rotation of the earth, as given above, seems to be in very good agreement with all principal characteristics of the formation of its crust. No essential additions have to be made in order to draw the conclusion that there are no contradictions with the characteristics taken from geology. As to the accumulation of the matter around a shield by folding, this process can be easily included in the general plan. Let us explain this by an example. Suppose the Old World, as required by the hypothesis of zonal rotation, was separated from the western continents and dragged by the underflowing magma<sup>1</sup> to the east (Fig. 2). The bottom of the newly created Atlantic Ocean could be partly formed by magma rising into the fissure, but the bottom of the Pacific was solid and also dragged to the east. On the other hand, the two western continents having a smaller area over the equatorial belt should be subjected to a smaller displacement to the east, or to none. Thus, the equatorial part of the bottom of the Pacific should exert a pressure along the western coast of America, and the folding of a continental strip parallel to the coast as well as of a strip of the ocean bottom becomes a well-explained phenomenon. It is evident that in the last case new folds could increase the land area. It seems to the author that in a similar way many changes in the size or shape of the continents can be clarified.

As to the cyclic character of the mountain building, it has been pointed out several times that the "flow" or creep in the solid crust could occur only in phases (12). The increasing viscosity of the underlying liquid magma was the factor that produced stresses large enough to overcome at a certain moment the resistance of the crust existing at that time. With the advanced cooling and a larger thickness of the crust, larger stresses were needed to produce the same effect, but

<sup>1</sup> To avoid a misunderstanding, the words "floating" or "underflowing" have a descriptive character only for later geologic periods. In the last case, for example, we mean extremely slow displacement of the plastic magma.

in the meantime, the magma became more viscous and the horizontal stresses could again reach a value required for a new folding. Such a process could be repeated until the crust became too thick for further changes on a larger scale.

Having in mind only to find a plausible mechanism of the formation of principal features in the earth's crust, the author was not concerned with the determination of the geologic periods during which the outlined events could occur. This remains to be done. Also, one can only say that if this mechanism worked throughout geologic history, there ought to be an internal source of energy producing the convection currents which themselves, as mentioned, would maintain the zonal rotation against the increasing viscosity. There is no indication that such a rotation has ceased to exist in the past. The existence of an energy source in the interior of the earth has been asserted at various times, but its exact nature is still open to speculation.

As mentioned, these few considerations show a good

agreement between the author's hypothesis of zonal rotation of the earth and the most important conclusions of geology and related sciences. And although much remains to be done, the way seems to be open to the understanding of many other characteristics of the formation of the earth's crust that were not discussed in this paper.

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## Samuel Clark Harvey: 1886-1953

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**S**AMUEL CLARK HARVEY died on August 22, 1953. His death came suddenly, in the midst of work, and terminated a career of courageous thought and action.

Doctor Harvey was born in Washington, Connecticut, February 12, 1886. He received his bachelor's degree from Yale College in 1907 and his degree in medicine from the Yale Medical School in 1911. He trained in pathology with MacCallum at the College of Physicians and Surgeons and in surgery with Cushing at the Peter Bent Brigham Hospital in Boston. After an interval with the U.S. Army Base Hospital No. 5 overseas, he returned to Yale as a member of the faculty and was appointed professor and chairman of the Department of Surgery in 1924. In 1947 he relinquished this chair to become professor of oncology, and held this post until his retirement in 1950.

His position in American surgery derived from pre-eminence in the classroom and laboratory, as well as in the operating theatre. To him, surgery represented a compendium of medical knowledge, encompassing all divisions and recognizing no artificial boundaries. He was not a specialist in any one field but a master in all. His operative procedures were characterized by superior technical ability, combined with infinite patience but, in essence, they were classic demonstrations of applied physiology and pathology. Not only was he the surgeon's surgeon but also he was the physician's physician. Above all, he was the patient's doctor, and his calm considerateness at the bedside evoked a degree of trust and confidence that gave dignity to pain. Such healing left few scars.

His teaching, based on the unorthodox assumption that the student of medicine was an intelligent individual, went beyond instruction to stimulate a lasting inquisitive interest. Learning, to him, was not a passive acquisition of established knowledge but a fresh dynamic experience of the mind. To him the function of the teacher was to inspire with enthusiasm rather than to supplant critical judgment. His ability to arouse speculative interest reflected a deep personal sense of the necessity for constant inquiry, and the rich flavor of his teaching stemmed from participation in many fields of intellectual endeavor.

His research interests were concerned with the phenomena of growth and development as applied to both tissues and ideas. Early experiments on the genesis of the pia-arachnoid and later investigations of wound healing revealed a keen insight into biological processes and led to lasting scientific contributions. His historical and philosophical essays reflect a wealth of knowledge and thought and will be relished, as well, for their style and concept.

He was active in medical and scientific affairs on a national as well as a local scale and was honored by election to the presidency of a number of distinguished societies. He served on a wide variety of governing boards and his wisdom and understanding of men and events rendered his counsel invaluable. In the medical school, he was instrumental in the introduction of broad new concepts and programs and his progressive outlook and sound critical judgment were dominant factors in the determination of institutional policy. A remarkable ability to clarify a confounded situation

with a concise and penetrating analysis made his discussions and opinions sought after and remembered. His considerate concern was not influenced by the status or problem of the petitioner.

Doctor Harvey possessed great personal charm. His bearing was distinguished by an old-fashioned courtesy and an air of kindness that prompted unreserved confidence. He had a fine sense of humor and his ready wit, combined with an aptitude of expression, made casual conversation memorable. His tastes were simple. He was rarely without his pipe and the smell of good tobacco is an integral part of his memory. A boyhood in Washington County bred an enduring love of the

country and of farm life. The planting and cultivation of a garden or the care of farm animals gave continued pleasure throughout his life, but his greatest enjoyment was obtained at the cook stove, where he displayed a unique skill. His rooster pie was an unforgettable experience, his johnny cakes were a tribute to the traditions of a neighboring state.

Doctor Harvey was a savant in many fields, a great surgeon, and a cultured gentleman, but above all, he was a man of good will. His great interest in people and his unfailing concern in their well being set him apart. His presence was reassurance, his memory will be inspiration.

## Albert Sterling Eisenstein: 1918-1953

Newell S. Gingrich

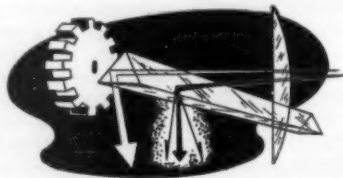
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THE University of Missouri suffered a great loss on December 16, 1953, by the death of one of its most vigorous and productive young physicists, Professor Albert S. Eisenstein, but his outstanding performance during his short career gives the University reason to be proud to have been his alma mater and later to have had him on its staff as professor of physics. After a brilliant record as a graduate student for three years, Albert Eisenstein earned the Ph.D. degree in 1942 and then for three years contributed to the war effort by his work in the Radiation Laboratory at Massachusetts Institute of Technology. After this, he was one of the first Jewett Fellows at MIT and a research associate at the same institution before accepting a position as associate professor of physics at Missouri in 1947. Recognizing his unusual abilities, the University promoted him in 1951 to professor of physics at the early age of 33. In the brief span of 13 years he contributed 19 publications, presented many papers at scientific meetings, directed the work of over a dozen candidates for the Ph.D. degree and many M.A. candidates, negotiated for and directed research contracts and grants to the University of Missouri that totaled about \$300,000, carried his professorial duties with distinction, and was active in many scientific organizations.

Professor Eisenstein was a man whose characteristically vigorous efforts were habitually directed toward the completion of some constructive enterprise. This was equally true when he worked alone as an experimental physicist or when he dealt with students or colleagues. Nevertheless, he was not unmindful of the importance of harmonious dealings in personal relations, for he was tactful and sympathetically considerate of others. In addition to his unusual ability as an experimental physicist and his interest in people, he was skilled as an organizer, in which capacity he thought more of the common welfare than of personal benefit. He was endowed in generous measure with intellectual curiosity and honesty, with a reliable sense of integrity, and with a compelling drive to contribute significantly in the field of his professional interest.

Former students and colleagues held Professor Eisenstein in high esteem and many of them have made contributions to a memorial fund in his honor to be used in some way connected with graduate work in the Missouri Department of Physics.

We mourn his loss to physics and to us as associates but we are not unmindful of the sorrow that his close relatives now experience. He is survived by his mother, Mrs. Leo Eisenstein, sister Jean, widow Edith, and two children, Eric and Jane.



# Joseph Oscar Wilhelm: 1899-1953

W. J. Mackey

*Research Council of Ontario, Toronto 5, Canada*

**J**OSEPH OSCAR WILHELM, O.B.E., B.Sc., M.A., Director of the Research Council of Ontario, died in Toronto General Hospital on November 19, 1953, after a short illness. His death at the age of 54 cut short a distinguished career.

Professor Wilhelm was born in Shakespeare, Ontario. Educated at the University of Saskatchewan and the University of Toronto, he lectured in the physics department of the latter university from 1927 to 1948. He served, on leave of absence in World War II, as technical assistant to the president of Research Enterprises Limited, with the National Research Council of Canada, with the R.C.A.F. as director of Operational Research, and with the federal Department of Reconstruction.

Following the war he was secretary of the Ontario Research Commission, 1945-48. Their work resulted in the establishment of the Research Council of Ontario. As director for the Council since 1948, his energy and ability were largely responsible for the organization of more than 250 representatives of industry, government, and universities in various research committees concerned with technical problems

affecting Ontario's natural resources and the supply of scientists. In this work his deepest faith lay in new generations of students whose possibilities inspired his efforts.

In addition to many other affiliations, both with community organizations and professional groups, he was first vice-president of the Royal Canadian Institute and chairman of the board of Knox Theological College, Toronto. He was well known to many scientists in Britain and the United States. A recognized authority on low temperature physics, he was equally at home with men and ideas. His bent for organization sprang from his imaginative grasp of problems outside his own field, his fresh and stimulating spirit, and his capacity for friendship. Always willing to attempt the difficult, he was devoted to the public welfare. His early death was a shock to his many colleagues and friends, a distinct loss to Canada and the community in which he lived.

In 1927 Professor Wilhelm married Nan Kathleen Munro of Saskatoon. He is survived by his widow, a son Donald who is at present in England; and a daughter Mildred, who is now attending high school.



## News and Notes

### High Polymer Chemistry

THE Fifth Canadian High Polymer Forum, cosponsored by the Chemical Institute of Canada and the National Research Council of Canada, was held in London, Ontario, Nov. 19-20, 1953. Papers were presented on all phases of high polymer chemistry.

Polymerization reactions revealed a continued trend to more basic investigations. A. D. Macallum described the preparation of phenylene monosulfide copolymer resins from *p*-dichlorobenzene or trichlorobenzene by fusion with sodium carbonate and sulfur. W. F. Graydon has found differences in equilibrium quotient between ion-exchange resins prepared by sulfonating cross-linked polystyrene and hydrolysis of esters of *p*-styrene sulfonic acid of equivalent nominal cross-linking and capacity. C. G. Overberger described the recent work on polymerization of styrene using stannic chloride catalyst in solvents such as carbon tetrachloride or nitrobenzene and concluded that it was possible to assign a nucleophilicity factor for attack of an ion pair on an aromatic nucleus. M. Talat-Erben has found an intermediate in the decomposition of 2,2'-azobisisobutyronitrile and has isolated products which could arise from this intermediate. The mechanism

of the reaction is suggested to be scission of the nitrile to yield the intermediate and hydrolysis of the intermediate to yield such products as *N*-isobutyryl alpha amino isobutyric acid and the corresponding amide. D. James described the polymerization of acrylonitrile in aqueous solution, using hydrogen atoms or hydroxyl radicals formed photochemically from dissolved inorganic ions. L. Gendron described the method of determining the relative amounts of 1,2 and 1,4 addition in butadiene polymerization for forming the dimer in dilute chloroform solution with acetyl peroxide as initiator, followed by infra-red analysis and ozonolysis of the mixed dimers.

Properties of solutions of polymers continue to be of great interest to high polymer chemists. U. P. Strauss found that the viscosity of a polysoap solution, such as quaternized polyvinyl pyridine in solution, varied with the type of hydrocarbon being solubilized. These changes were interpreted as caused by changes in the size of the micelles and to interaction of the polysoap molecules. L. H. Cragg reviewed the significance of the viscosity slope constant in revealing the changes in branching of polystyrene and butadiene-styrene copolymers and other differences of the

structure of the polymer molecule and its configuration in solution. R. B. MacFarlane found that, for high molecular weight butadiene-styrene copolymers, the viscosity constants in dilute solution may require a quadratic term in concentration when the Mead equation is used, whereas the Huggin's equation is adequate in its usual form. R. Simha described a theory of adsorption of high polymers from solution and showed that the resulting isotherm should differ from a Langmuir isotherm in several respects. R. F. Boyer described the experiments on the viscosity of extremely dilute solutions of polystyrene in which the specific viscosity/concentration versus concentration goes through a maximum. The explanation lies in the expansion of the molecule in solution free from interaction with other molecules. S. H. Maron described light-scattering studies on pure liquids and polymer solutions, from which he concluded that the absolute Rayleigh scattering was in good agreement with published data as well as with the predictions of the Einstein equation for the scattering of pure liquids. M. Rinfret measured the heats of mixing and dilution of polyvinyl acetate and polystyrene solutions and in that way was able to classify solvents according to their effectiveness.

Properties of polymers were studied mostly with respect to the effect of applied stresses. Fensom has interpreted the changes in the reading on a Mooney instrument in terms of the structure of the rubber molecules and their entanglement. D. G. Ivey has found two linear curves in his study of stress-temperature-time phenomena through the second-order transition region and suggested that the intersection might be used to define the transition temperature for the process. D. G. Ivey has also measured dynamic shear modulus in solid rubber at ultrasonic frequencies and found that the preliminary data agree with those obtained from the bulk wave data on the basis of some assumptions. H. L. Williams reported that the contact angle of films of rubber varied with the amount of emulsifier relative to the amount of polymer but in particular with the amount of acrylonitrile comonomer in the polymer. K. B. Goldblum found that it was possible to measure the heat of combustion of organo-silicon compounds and polymers and arrived at the conclusion that the Kharasch type heat of combustion per electron of the silicon to carbon bond was 39.1 kcal for alkyl substituted and 33.3 kcal for aryl substituted compounds. E. L. Falconer described the results of reacting the methylated cellulose dinitrate, prepared from cellulose trinitrate and hydroxylamine in pyridine, with ammonium hydrosulfide to yield a 1.1 methylated cellulose. Upon hydrolysis, this yielded mostly 2-methyl glucose.

Papers most specifically aimed at degradation of high polymers concluded the scientific sessions. C. Sivertz described the oxidative degradation of polymers initiated by the thermal decomposition of azobisisobutyronitrile in solution in a sealed viscometer. By this technique he was able to estimate the energy of activation of the over-all reaction and the reaction

leading to chain scission as well as to measure the effectiveness of antioxidants. L. A. Wall has extended the studies on degradation of polymers by using deuterated polymers, from which he concludes that the transfer step in the reaction mechanism is important and that both this step and the depropagation step may exhibit isotope effects. C. R. Masson has measured the rate constants for degradation of carrageenin and found a low-temperature rapid reaction accompanied by an increase in sulfate content and reaction above 60° C, which was first order and was represented by an energy of activation of 29.5 kcal.

Following the forum dinner, D. P. Riley spoke on the structure and interaction of biological macromolecules, particularly with relation to the organization necessary for life and how the known mechanism of reactions could account for organisms and life.

The executives chosen for the next forum, to be held early in 1955, are R. V. V. Nicholls, chairman, H. Leverne Williams, program, and D. G. Ivey, secretary-treasurer.

H. LEVERNE WILLIAMS

*Polymer Corporation Limited  
Sarnia, Canada*

## Meeting of the American Institute of Electrical Engineers

THE IMPORTANCE of the engineer was stressed by Elgin B. Robertson, president of the American Institute of Electrical Engineers, at the opening session of the five-day Fall General Meeting of the Institute. "The average person has no conception of the part played by engineers in those things with which the average person comes into daily contact," Mr. Robertson told the approximately 1000 engineers and scientists from all over the country.

During the 25 sessions the engineers listened to and discussed the latest advancements in the fields of switchgear, communications switching systems, feedback control systems, electrical techniques in medicine and biology, safety, industrial power systems, petroleum pipe lines, aural and television broadcasting management, petroleum production and refining, electrical developments in eastern and western mining, transmission and distribution, radio communication systems, cathodic protection, power generation, computing devices, transformers and protective devices, and system engineering.

In the technical sessions, G. L. Bush, of Teleregister Laboratories, New York, described the use of small selenium rectifiers in operation of a stock exchange quotation system, by which stock prices can be obtained by dialing a number. Prices are stored on a magnetic drum and relayed by telephone.

W. R. Wilson, of General Electric Co., described exhaustive tests made on electrical contacts. Approximately 15,000,000 tests were made of 750 silver contact pairs, such as those used in refrigerators, ranges, and other household devices, to determine the point of failure.

A new automatic method for testing telephone switching equipment was described by A. N. Hanson, Western Electric Co., Chicago. A new device, known as the Universal Equipment Test set, eliminates undesirable features of manual testing, but retains complete flexibility.

Ralph J. Osborn, Sinclair Pipe Line Co. engineer, predicted that remote automatic control of large pipeline pumping stations would be even more widely used in the future. The unattended operation, however, places greater emphasis on the reliability, simplicity, and ruggedness of electrical equipment, he warned.

One of industry's newer devices, the mercury electric switch, has been put into "work clothes," and is now doing heavy industrial duty, Arthur L. Riche, vice president of Micro, a division of Minneapolis-Honeywell Regulator Co., said in a safety session. The switch, which, among other things, protects the housewife when she opens her washer, may be cast into a solid block inside a metal can, for rough operations.

Use of the "compandor," a tiny device for improvement in radio and telephone communications, was reported by F. S. Boxall and R. S. Caruthers of the Lenkurt Electric Co. The device has been used to reduce noise and cross talk on open wire telephone systems for some time, but now also is used in cable and open wire carrier systems. The compandor they described "differs from any previously developed in being smaller, more compact, and using fewer vacuum tubes." It may be used in FM radio systems, VHF and microwave bands, carrier systems, in established systems that have deteriorated, and in railroad and pipeline circuits to improve their performance, they said.

An experimental microwave system on the Santa Fe Railroad that reduces communications distance between Galveston and Beaumont, Tex., from 315 to 70 miles, was reported by L. R. Thomas of the Atchison, Topeka, and Santa Fe Railroad. The new system spans Galveston Bay and replaces overland telephone and telegraph circuits that linked the two places.

"Radio has truly become one of the indispensable tools in the petroleum industry's never-ceasing struggle to supply the products that make possible our industrial civilization," W. M. Rust, Jr. of the Humble Oil Co. told a petroleum session, in describing the National Petroleum Radio Frequency Coordinating Association in the South and Southwest. Radio is vital to exploration geophysics, drilling, control of pipeline operations, tanker operation and marketing, he said.

When ice and sleet cover the countryside, the electrical engineer has a vital job keeping distribution lines open. O. L. Oehlwein, Public Service Co., Chicago, reported. He can take lines out of service and de-ice them by overloading, or he can utilize a relatively new procedure, angular displacement of the voltages to circulate sufficient current to heat conductors and melt ice on the lines. "This method," Mr. Oehlwein said, "holds great promise for those long, lightly loaded lines in the modern and lower voltage class which so often fall prey to these storms."

## Science News

In an article in the Feb. 27 *Saturday Review* on the late Edwin H. Armstrong, radio engineer whose tragic death occurred on Feb. 1, R. D. Darrell said:

As it is, the premature death of a man like Armstrong has for many of us the poignance of an irreplaceable personal loss, and should have for many more the impact of a general contemporary tragedy. Another of my few true heroes who still live, H. M. Tomlinson, best expressed my present feelings, when he wrote after the death of Conrad, "Once we were so assured of the opulence and spiritual vitality of mankind that the loss of a notable figure did not seem to leave us any the poorer. But today, when it happens, we feel a distinct diminution of light."

The question becomes ever more pressing: Can we afford the loss of such too-seldom replenished light in a world of gathering darkness?

The following excerpts concerning the Arnold Arboretum of Harvard University are taken from a letter to the *Harvard Alumni Bulletin* (Dec. 12, 1953) from John S. Ames, president of the Massachusetts Horticultural Society; Grenville Clark, lawyer and a former member of the Harvard Corporation; and Ellery Sedgwick, former editor of the *Atlantic Monthly*.

There has recently been filed with the Supreme Judicial Court of Massachusetts a lawsuit relating to the Arnold Arboretum which may be of consequence in Harvard's history. The ten petitioners . . . represent a not inconsiderable body of devoted friends of the Arboretum and the College. . . .

The relief sought is a review of a decision by an Assistant Attorney General of Massachusetts refusing permission for a test suit in the Attorney General's name to determine whether the plan set forth in a vote of the Harvard Corporation on January 19, 1953 would involve a breach of Harvard's obligation as trustee for the Arboretum. Having itself refused to apply to the courts for advice, the Corporation also opposed the petitioners' application to bring a test suit in the Attorney General's name, which is the usual and perhaps only method to obtain a judicial ruling in such a case. . . .

The Corporation's vote of January 19, 1953 concedes that the Arboretum's funds and other property are held by the Corporation under a special trust to be administered in the best interests of the Arboretum. Nevertheless, this same vote calls for the removal from the Arboretum at Jamaica Plain to the new Botanical Building in Cambridge of the major part "related to research" of the Arboretum's remarkable library and almost unique herbarium. Since the herbarium and library are almost wholly "related to research," that phrase would hardly restrict the proposed removal at all, so that in practice the plan would doubtless result in the removal from the Arboretum to Cambridge of all but a small part of the library and herbarium. The vote also calls for the use of some of the Arboretum's endowment for maintenance of the new building and contains other features the legal validity of which is questioned.

While the Corporation asserts that this plan would be in the Arboretum's interest, the petitioners claim that, according to the overwhelming opinion of impartial authorities, the removal and other features of the plan would

be plainly detrimental to the Arboretum (whether or not it would benefit botany at Harvard) and would, consequently, constitute a breach of trust.

What the petitioners are now seeking is merely an opportunity to establish this claim by a judicial trial on the merits. The petition alleges that by its refusal to cooperate in obtaining a judicial ruling the Corporation has departed from the usual and proper practice of trustees. . . .

Never before in Harvard's history has the Corporation sought to avoid a judicial ruling as to the legality of its administration of trust funds where, as in this case, serious questions as to a possible breach of trust have been raised by responsible persons upon the advice of distinguished counsel. . . .

It is still open to the Corporation to cooperate in the submission of the legal issues for authoritative decision by the Massachusetts courts. With many others we still hope that the Corporation will listen to this earnest appeal that it shall cease to oppose a judicial test.

Development of a microwave impedance bridge by the Research Division of New York University's College of Engineering has been announced. The instrument permits rapid, precision measurement of impedance in the frequency range of 400-1600 megacycles. It eliminates the tedious, time-consuming, and costly impedance measurements now made with slotted-line technique. The instrument was developed under sponsorship of the Navy's Bureau of Ships in a project directed by David M. Goodman.

Stanford University's billion-volt, super-high-frequency, 200-foot-long electron linear accelerator is going to be made in junior sizes for cancer therapy and for the inspection of industrial products. The "toned down" accelerators will be manufactured and sold by the X-ray Department of General Electric Company under a 10-year agreement with the University. They should be on the market within the next few years.

## Scientists in the News

The Institute of Metals, London, England, has awarded the following medals for 1954:

The Institute of Metals Medal to **Leslie Aitchison** in recognition of his services to metallurgy in industry, in education, and in public service.

The Rosenbain Medal to **Alan Howard Cottrell**, professor of physical metallurgy, University of Birmingham, in recognition of his contributions to the field of physical metallurgy, with special reference to the deformation of metals.

**F. G. Arndt**, who is on leave of absence from his post as chairman of the Department of Chemistry at the University of Istanbul, is a visiting professor at Indiana University. In addition, he will give the Reilly Lectures at the University of Notre Dame and the Priestley Lectures at Pennsylvania State University this year.

The 1953 Glycerine Research Awards of the Glycerine Producers' Association are as follows:

First prize of \$1000 and an honor plaque was pre-

sented to **Erich Baer** of the University of Toronto for having duplicated by synthetic methods a group of biological glycerol derivatives present in animal cells, liver, and brain tissues, but extremely difficult to isolate from these natural sources. His work has opened the door to further fundamental studies that will lead to increased knowledge of the way the body converts food into tissue constituents used for growth, repair, and energy.

Second prize, \$300 and honor plaques, was shared by **Lewis I. Gidez** of the Brookhaven National Laboratory and **Manfred L. Karnovsky** of the Harvard University Medical School. They developed methods for incorporating radioactive carbon into glycerol and glycerides. They then administered these compounds to rats, and by means of the tagged carbon, traced the conversion of these materials into respiratory carbon dioxide, blood sugar, liver glycogen, and tissue lipides.

**Albert C. Nuessle** of Rohm and Haas Company, Philadelphia, and **Russell F. Crawford, Jr.**, of Sharon Hill, Pa., shared the third award of \$200 and plaques. They found that a crisp, washfast finish could be imparted to nylon fabrics by reacting polyacrylic acid and glycerine with the surface molecules of the nylon.

**Donald J. Belcher**, director of the Cornell Center for Aerial Photographic Studies, has gone to Rangoon, Burma, to initiate a year-long program of aerial photographic training for Burmese nationals. With the support of the U.S. Foreign Operations Administration, the Burmese government has contracted with Cornell to train Burmese specialists to use aerial photographs in the fields of forestry, soils, urban and land planning, geology, and agriculture.

**Ta Liang**, of the Center's staff, will be field director in Burma for a major portion of the program; a visiting professor at Cornell, he served as a senior engineer with the U.S. Army during World War II and has been with the Center since its inception in 1950. Another member of the team is **T. M. Bushnell** of Purdue University, director of the Indiana Soils Survey, who has had wide experience in Japan and Central America. **Ernest Stoeckeler**, on leave from the U.S. Forest Service, will supervise the forestry division of the work.

**Carl C. Chambers**, dean of the Moore School of Electrical Engineering at the University of Pennsylvania, has been elected vice president of the University in charge of engineering affairs. He will be responsible for chemical, civil, mechanical, metallurgical, and electrical engineering education.

**Allan Chilton**, formerly with the Wright Aeronautical Division of Curtiss-Wright Corporation, has been appointed chief engineer for the Aviation Gas Turbine Division of the Westinghouse Electric Corporation.

**Herschel H. Cudd** has been appointed to the newly created position of manager of research and development by the American Viscose Corporation. Dr. Cudd has resigned as director of the Engineering Experi-

ment Station at Georgia Institute of Technology and will occupy his new post effective April 1.

**John H. Davis** will resign this spring as Assistant Secretary of Agriculture to become director of the Moffett Program in business and agriculture at the Harvard University Graduate School of Business Administration.

**I. S. Falk**, director of research and statistics in the Social Security Administration, has joined a mission being sent to Malaya and Singapore for 3 mo by the International Bank for Reconstruction and Development. The mission is surveying the economies of the two countries and making recommendations for long-range development. Mr. Falk will be the Advisor for Social Services (including health, education, welfare, and related activities). He is on leave of absence for this assignment, but will resign from his present position effective June 30.

In recognition of his outstanding contributions to the advancement of heating, ventilating, and air conditioning, **Walter L. Fleisher** of New York was the recipient of the F. Paul Anderson Medal for 1953, awarded by The American Society of Heating and Ventilating Engineers.

**Henry T. Harrison**, manager of weather service for United Air Lines, is the recipient of the Robert M. Looney Award for 1953, bestowed by the Institute of Aeronautical Sciences "in recognition of outstanding contributions to the science of meteorology as applied to aeronautics." Mr. Harrison has been engaged in aeronautical meteorology since 1924. In 1928 he accompanied the Byrd Antarctic Expedition.

**Molly R. Harrower**, clinical psychologist of New York City and director of the research program of the Court Intake Project of the Family Relations Court of New York City, has accepted appointment as lecturer in clinical psychology at the University of Texas Medical Branch. Dr. Harrower will be in residence in Galveston for several weeks in February and March of each year. She will conduct special seminars and demonstrations illustrating the way in which clinical psychologists may cooperate in current medical problems.

**Bernard L. Horecker** of the National Institute of Arthritis and Metabolic Diseases and an authority on the chemistry of enzymes, has won the 1954 Hillebrand Award of the American Chemical Society's Washington Section.

**Eugene J. Houdry** of Ardmore, Pa., has been presented with the John Scott Medal Award—a medal, a scroll, and \$1000—administered by the Philadelphia Engineers Club. Houdry was honored for his achievements in the catalytic cracking of petroleum. The cracking process that he originated reshaped the oil industry and at present is in almost universal use in the production of high octane gasoline.

**Thomas W. Jackson**, formerly aeronautical research

engineer with the U.S. Air Force working at the Atomic Energy Commission in Washington, has been appointed head of the Mechanical Sciences Division of the Georgia Institute of Technology Engineering Experiment Station.

Creation of a Cornell Aeronautical Laboratory Professorship and the naming of **Mark Kac** of the Cornell University mathematics staff as first appointee have been announced by the university. The chair may be rotated among members of the faculty. The incumbent will spend approximately one month of the year at the laboratory, and the remainder in teaching and research on the campus. C.A.L., a self-sustaining subsidiary of the university, engages in military and industrial research. Last year it handled contracts with a total value of \$9,200,000.

**George G. Mallinson**, professor of psychology and education at Western Michigan College, became director of the college's graduate division on Feb. 1.

In recognition of **Harrison E. Martland's** 46 years of public office and medical practice, the city of Newark, N.J., has dedicated its new \$13,000,000 hospital, now under construction, as the Harrison E. Martland Medical Center. Dr. Martland, an authority on radioactive diseases, resigned recently after 25 yr as chief medical examiner of Essex County; he has been city pathologist for 45 yr.

It was a generation before atomic fission that Dr. Martland first encountered symptoms of radioactive poisoning among women who worked in a watch factory. Several died and autopsies evolved a new pathological pattern. In applying luminous paint to dials, the women had absorbed minute doses of radioactive materials by touching paint brushes to their lips. When the Manhattan Project was started during World War II, Dr. Martland was appointed to outline the requirements for protection of employees at the Oak Ridge plant.

An instructor in forensic medicine for many years at New York University, Dr. Martland is a past president of the New York Pathological Society and a former president of the New Jersey and Essex County Medical Societies. In 1939 the New Jersey Pathological Society established in his honor an annual Harrison E. Martland Medical Lecture. Three Noble Prize winners have been the lecturers in recent years.

**J. Alex Munro**, professor and chairman of the Department of Entomology at North Dakota Agricultural College, has resigned after 25 years of service in North Dakota. He has also served as Entomologist of the North Dakota Experiment Station, State Entomologist for North Dakota, and Collaborator for the Bureau of Entomology and Plant Quarantine of the U.S. Department of Agriculture. Dr. Munro is the author of approximately 150 articles and other publications dealing with economic entomology. For the past two years he has been on leave to act as research entomologist for the Point IV Program in Bolivia.

He is now continuing this assignment under the Foreign Agricultural Service of the U.S. Government.

The first annual Judson F. Swearingen Award for outstanding scientific research conducted at Southwest Research Institute has been won by John P. O'Meara and William L. Rollwitz, both of the Physics Department, for their "pioneer work in nuclear resonance at low magnetic field strengths."

Russell J. Seibert, director of the Los Angeles State and County Arboretum, Arcadia, Calif., has been appointed director of the recently created Department of Arboreta and Botanic Gardens for the County of Los Angeles.

Maurice M. Shapiro, head of the Cosmic Ray Branch of the Naval Research Laboratory, Washington, D.C., has been named superintendent of the Nucleonics Division of the Laboratory, succeeding F. N. D. Kurie who has become technical director of the U.S. Navy Electronics Laboratory in San Diego. Dr. Shapiro will continue to direct cosmic ray research.

Arthur W. Thomas has been designated as the 1954 recipient of the Henry Hurd Rusby Award. This award is given by the Alumni Association of the Columbia University College of Pharmacy in recognition of Prof. Thomas' contributions to the College program during the many years he served as Columbia University representative to the College, as an actively participating member of the Board of Trustees, and as the head of the University's Department of Chemistry.

## Education

The University of New Mexico has announced that the 23rd annual **Field Sessions in Anthropology** will be held from June 16 through July 26. The emphasis of the sessions is on training in archaeological field work by specialists of experience in the southwestern area. For details, address Dr. Frank C. Hibben, University of New Mexico, Albuquerque, N.M.

The Ames Laboratory of the U.S. Atomic Energy Commission at Iowa State College, under the direction of F. H. Spedding, has completed construction of a "hot canyon" area for experiments in reprocessing atomic fuel for re-use in power reactors. This area, designed for handling fissionable materials and high level radioactivity, is located on the two lower floors of the Laboratory's Research Building.

Within the 60-by-28 ft canyon is the "hot cave," a trough 33 ft long in which the radioactive material is placed. Shielded from the "hot" material by an 8-in. steel wall 10 ft high, workers conduct experiments in the cave by means of remote-control devices sometimes called "master-slave manipulators." Lead glass windows permit operators to view their work. The wall is equipped with offset plugs through which the utilities can be led in to the experimental area. The canyon also has its own ventilating system to maintain a constant supply of fresh, uncontaminated air and to

insure that only uncontaminated air is discharged to the atmosphere.

Some of the features of the canyon are similar to those found at other AEC installations where work with high-level radioactivity is in progress. Much of the equipment, however, is of a specialized nature and was specifically designed or adapted for the local work by Gordon Winders, a mechanical engineer on the Laboratory staff. Ray Fisher, group leader in charge of building and engineering services, directed the general design of the canyon. In direct charge of the experimental studies are Adolph Voigt, who oversees the radiochemical research, and Adrian Daane, who supervises the metallurgical aspects.

The special program in **infra-red spectroscopy** will be given during the 1954 Summer Session from July 19 to July 30 at the Massachusetts Institute of Technology. Offered jointly by the Institute's Spectroscopy Laboratory and Department of Chemistry, the program is designed for those who wish an introduction to infra-red instrumentation and laboratory methods and for those interested in the use of infra-red spectra in the solution of chemical problems.

There will be two integrated 1-wk courses, one on the technique of infra-red spectroscopy and the other, on the applications of infra-red spectroscopy under the direction of Richard C. Lord, director of the Spectroscopy Laboratory at MIT, and Foil A. Miller, in charge of the Spectroscopy Laboratory at the Mellon Institute of Industrial Research. Application forms and further information can be obtained from Dr. E. H. Huntress, Director of the Summer Session, Massachusetts Institute of Technology, Cambridge 39.

The Special Training Division of the Oak Ridge Institute of Nuclear Studies will offer three basic **isotope techniques courses** during the summer months. Starting dates of the 4-wk courses are June 14, July 12, and Aug. 9, 1954. The laboratories, counting room, and lecture room of the Special Training Division have been remodeled and enlarged, and the Institute's library will soon occupy new quarters recently added to the Training Building. Additional information on the courses may be obtained from the Special Training Division, P. O. Box 117, Oak Ridge, Tenn.

The **Jackson Hole Biological Research Station** will be available for use by research workers in the biological sciences from June 10 to Sept. 10, and at other times during the year by special arrangement. This Station, which is located at the foot of the Teton Mountains near Moran, Wyo., is administered by the University of Wyoming under agreement with the New York Zoological Society. Projects in basic ecology, taxonomy, and behavior are encouraged, and opportunities for research in the practical aspects of conservation, game management, and fisheries biology are also offered. Students may register for credit at the University of Wyoming for research projects undertaken at the Research Station. Facilities available include a laboratory, a library, and sleeping quarters. Inquiries should be addressed to L. Floyd Clarke, Department

of Zoology and Physiology, University of Wyoming, Laramie.

The Marine Laboratory of the University of Miami at Coral Gables, Fla. will offer two courses in the marine sciences in the six-weeks summer session, June 14-July 24: "Introduction to marine biology," and "Introduction to oceanography." Detailed information may be obtained from the Marine Laboratory or the Director of the Summer Sessions, Box 488, University of Miami, Coral Gables 46, Fla.

The Duke University Marine Laboratory at Beaufort, N.C. and the Mountain Lake Biological Station will offer courses in radiation biology during the summer of 1954. These courses will be implemented by visiting lecturers from the Biology Division of the Oak Ridge National Laboratory. From June 9 to July 17 there will be offered at Beaufort an introductory course dealing with the basic physical, chemical, and biological principles upon which study of the biological effects of radiation is based. Those interested should write to Dr. C. G. Bookhout, Director, Duke University Marine Laboratory, Durham, N.C.

A more specialized course which will emphasize the cytological and cytogenetic effects of radiation will be offered at the Mountain Lake Biological Station from July 22 to Aug. 25. For details address Dr. Bruce D. Reynolds, Director, Mountain Lake Biological Station, University of Virginia, Charlottesville, Va. These two courses have been so scheduled and integrated that both may be taken during the summer, or either may be taken as a separate course. Each course carries 6 semester hours credit.

St. John's University College of Pharmacy, Brooklyn, has announced the celebration of its 25th Anniversary on Apr. 24-25.

*Correction:* On p. 314 of the Mar. 5 issue, the item on the Marine Biological Laboratory at Woods Hole erroneously stated that Hewson Swift, recipient of this year's Frank R. Little Memorial Fellowship at the Laboratory, previously had been a director of MBL.

## Grants, Fellowships, and Awards

As a contribution to the meeting of the British Association for the Advancement of Science to be held in Oxford on Sept. 1-8, 1954, Imperial Chemical Industries Limited, publishers of the quarterly scientific review *Endeavour*, have offered the sum of 100 guineas to be awarded as prizes for essays submitted on a scientific subject. As the primary purpose of these awards is to stimulate younger scientists to take an interest in the work of the British Association and to raise the literary standard of scientific writing, the competition is restricted to those whose 25th birthday falls on or after June 1, 1954. Five *Endeavour* Prizes will be awarded: a first prize of 50 guineas; a second prize of 25 guineas; a third prize of 15 guineas; and two special prizes of 5 guineas each for competitors who have not passed their 18th birthday on June 1.

The subjects for the essays are: (1) The upper atmosphere; (2) Heat of the earth; (3) Coal as a raw material; (4) Water supply; (5) The span of life; (6) Color photography.

The essay must be in English and typewritten, and should not exceed 4000 words. It should be submitted without signature; the author's full name, address, and date of birth should be disclosed in a sealed covering letter attached to the essay. Only one entry is permitted from each competitor. Entries should be addressed, in an envelope clearly marked "Endeavour Prize Essay," to: The Assistant Secretary, British Association for the Advancement of Science, Burlington House, Piccadilly, London, W.1. The latest date for receipt of entries is June 1, 1954.

The essays will be judged by the editors of *Endeavour* in consultation with representatives of the British Association. The successful competitors will be invited to attend the whole of the Oxford meeting, at which the prizes will be presented, and their expenses within the United Kingdom will be paid. The judges' decision is final, and they reserve the right to withhold all or any of the prizes should no entries of sufficient merit be received.

The names of the contestants will not be disclosed to the judges until after the prize-winning essays have been selected. In judging the results, special attention will be paid to the originality of the approach to the subject and to literary style. The competitor's age will also be taken into account. The essay winning the first prize will be published in *Advancement of Science*, journal of the British Association.

The School of Biological Science at the University of Tennessee, Memphis, has announced the availability of graduate fellowships in biochemistry and lists the following information for applicants:

1. Teaching fellows are allowed half-time graduate residence credit during the fall, winter, and spring quarters. During these quarters fellows carry a teaching load of 6-9 hr/wk, generally in laboratory instructing or assisting.

2. Fellows may enroll on a full-time graduate credit basis during the summer quarters.

3. Normally teaching fellows will require six quarters to satisfy the requirements for an M.S. degree. The additional time necessary to qualify for the Ph.D. is less predictable, but may be shortened substantially by continuing the graduate program during the summer quarters.

4. Graduate students who major in biochemistry carry minors in anatomy and physiology.

5. Tuition fees, including fees for summer quarters, are remitted for teaching fellows. Salaries are paid in 10 equal monthly installments beginning with the month of September. Currently, the salary scale provides \$1200 during the first and second years for candidates for the M.S. degree. Fellows who hold an M.S. and are candidates for the Ph.D. start at a salary of \$1500 and receive annual increments up to a maximum annual salary of \$2400.

The National Science Foundation has announced 100 grants totaling about \$1,045,000 for research in the biological and the physical sciences, and to support studies and conferences on science, scientific information exchange, compilation of scientific personnel information, education in the sciences, and travel of American scientists to international scientific meetings. This is the second group of awards to be made during fiscal year 1954 by the Foundation. The duration of research grants in this group ranges from 1 to 5 yr, with an average length of 2.2 yr.

Harvard University. D. Hoffelt, Harvard Observatory. Variable stars in the Milky Way, 2 yr, \$5500.

University of California, Berkeley. D. W. Mitchell, Inst. of Engineering Research. Structure of molten silicates by measurements of partial molar volumes, 1 yr, \$3000.

University of Delaware. E. Dyer, Dept. of Chemistry. Effect of oxygen on vinyl compounds in the presence of free radicals, 18 mo, \$10,000.

Georgia Institute of Technology. J. Hine, Dept. of Chemistry. Effect of halogen atoms on reactivity of other halogen atoms in the same molecule, 2 yr, \$10,000.

Washington University. A. C. Wahl, Dept. of Chemistry. Kinetic studies of oxidation-reduction reactions, 2 yr, \$17,700.

Macalester College, St. Paul, Minn. W. S. Glock, Dept. of Geology. Tree growth and climate, 3 yr, \$13,000.

Columbia University. J. L. Kulp, Dept. of Geology. Time relations of ocean floor sediments, 1 yr, \$13,000.

Harvard University. W. O. Roberts, High Altitude Observatory. Observational studies of solar activity, 1 yr, \$10,000.

Washington University. J. C. Brice, Dept. of Geology. Pleistocene geology of northeastern Missouri, 2 yr, \$3500.

Vassar College. G. E. Baker, Plant Science Dept. Microorganisms in lake water, 3 yr, \$5300.

Lehigh University. A. C. Zettlemoyer, Dept. of Chemistry. Mixed vapor adsorption, 2 yr, \$6200.

Louisiana State University. J. Coates, Dept. of Chemical Engineering. Thermal conductivity of liquids and solutions as a function of temperature, 2 yr, \$13,800.

Northwestern University. A. B. Bronwell, Dept. of Electrical Engineering. Microwave conversion and detection, 1 yr, \$5000.

South Dakota School of Mines and Technology. W. A. Hixson, Dept. of Electrical Engineering. Observable failures of electrically stressed transformer oil, 2 yr, \$3500.

Brown University. J. Federer, Dept. of Mathematics. Theory of measure and area, 1 yr, \$7000.

Institute for Advanced Study. H. Samelson, School of Mathematics. Topology of lie groups and spaces of paths, 1 yr, \$9200.

Lehigh University. E. A. Pitcher, Dept. of Mathematics. Problems in critical point theory, 1 yr, \$3000.

Princeton University. A. Church, Dept. of Mathematics. Preparation of results of basic research, 1 yr, \$5600.

University of Alabama. W. Pigman, Dept. of Biochemistry. Biologically significant reactions and interactions of nitrogenous carbohydrates and related substances, 3 yr, \$13,000.

University of California, Berkeley. H. K. Schachman and C. A. Dekker, Virus Laboratory. Mechanisms of enzymatic breakdown of proteins and nucleic acids, 3 yr, \$25,000.

Chicago Medical School. A. R. Goldfarb, Dept. of Biochemistry. Structure and reactions of the peptide bond in aqueous solution as indicated by ultraviolet absorption spectra, 1 yr, \$8000.

University of Chicago. L. Bogorad, Dept. of Botany. Enzymatic synthesis of porphyrins from porphobilinogen, 2 yr, \$12,000.

Fordham University. F. F. Nord, Dept. of Organic Chemistry. Structural, biochemical, and physico-chemical studies of lignin, 3 yr, \$21,000.

Harvard University. J. T. Edsall, Biological Laboratories. Physical chemistry of amino acids, peptides, and proteins with special reference to Raman spectra, 3 yr, \$30,000.

Harvard University. L. F. Fieser, Dept. of Chemistry. Role of steroids in health and disease, 3 yr, \$30,000.

Harvard University. A. F. Riggs, Biological Laboratories. Biochemistry of hemoglobin, 2 yr, \$3500.

University of Illinois. I. C. Gunsalus, Dept. of Bacteriology. Biosynthesis and function of microbial chromoproteins, 2 yr, \$11,000.

State University of Iowa. R. Benesch, Dept. of Biochemistry. Reactivity of sulfhydryl groups in peptides and proteins, 2 yr, \$12,000.

Montana State College. J. H. Pepper, Dept. of Zoology and Entomology, and L. H. Johnson, Dept. of Chemistry Research. Composition and structure of the cuticular components of the exoskeleton of the Mormon cricket, 2 yr, \$10,000.

University of Nebraska. H. Jehle, Dept. of Physics. Specific interactions of biological significance, 2 yr, \$10,000.

Princeton University. B. N. Harvey, Dept. of Biology. Biochemistry of light production in the Ostracod crustacean, *Cypridina hilgendorfi*, 3 yr, \$19,000.

Vanderbilt University. O. Touster, Dept. of Biochemistry. Origin and metabolic fate of *L*-Xylulose, 2 yr, \$8000.

Western Reserve University. H. Z. Sable, Dept. of Biochemistry. Intermediary metabolism of nucleic acid fragments, 2 yr, \$10,000.

Western Reserve University. J. B. Wittenberg, Dept. of Biochemistry. *In vitro* synthesis of sphingosine, 2 yr, \$3500.

Louisiana State University. J. M. Reynolds, Dept. of Physics. Electric and magnetic measurements on bismuth at low temperatures, 1 yr, \$9800.

University of New Mexico. J. R. Green and V. H. Regener, Dept. of Physics. Collision cross sections for cosmic ray showers, 2 yr, \$8900.

Western Reserve University. R. G. Winter, Dept. of Physics. Double beta decay, 1 yr, \$7600.

University of California, Berkeley. D. A. Riley, Dept. of Psychology. Rote learning, 1 yr, \$3400.

Duke University. G. A. Kimble, Dept. of Psychology. Avoidance learning, 2 yr, \$6100.

Duke University. K. Zener, Dept. of Psychology. Visual perception of spatial relationships, 2 yr, \$11,800.

State University of Iowa. D. Lewis, Dept. of Psychology. Perceptual-motor tasks, 2 yr, \$11,700.

University of Missouri. M. H. Marx, Dept. of Psychology. Experimental analysis of food handling behavior, 2 yr, \$8400.

Mount Holyoke College. J. Volkman, Dept. of Psychology. Visual perception, 2 yr, \$9800.

New York University. H. H. Kendler and T. S. Kendler, Dept. of Psychology. Problem-solving behavior, 2 yr, \$14,100.

University of North Carolina. L. L. Thurstone. Psychometric Laboratory. Multiple factor analysis, 2 yr, \$17,700.

Pennsylvania State College. J. H. Grosslight, Dept. of Psychology. Role of reinforcement in learning, 2 yr, \$7600.

Syracuse University. W. R. McAllister and D. E. McAllister, Dept. of Psychology. Eyelid conditioning and generalization of the conditioned eyelid response, 2 yr, \$12,300.

State College of Washington. F. A. Young, Dept. of Psychology. Systematic investigation of pupillary conditioning, 2 yr, \$11,400.

University of California, Berkeley. C. H. Sawyer, Dept. of Anatomy. Hormonal control of enzyme synthesis, 3 yr, \$6000.

University of California, Berkeley. P. K. Stumpf, Dept. of Plant Biochemistry. Oxidation of short chain fatty acids by plant extracts, 1 yr, \$1050.

Columbia University. H. Elftman, Dept. of Anatomy. Cytochemical investigation of phospholipids, 2 yr, \$9300.

Haskins Laboratories, New York City. L. Provasoli. Nutritional requirements of marine algae, 3 yr, \$9000.

Michigan State College. H. M. Sell, Dept. of Agricultural Chemistry. Biochemistry of growth substances in corn pollen, 2 yr, \$6900.

Northwestern University. C. L. Turner, Dept. of Biology. Hormonal control of growth and differentiation of regenerating tissue, 2 yr, \$9000.

Princeton University. J. T. Bonner, Dept. of Biology. Differentiation of the amoeboid slime molds, 3 yr, \$8800.

Childrens Hospital, Washington, D.C. S. P. Bessman, Research Foundation. Low energy transacylation in animal tissues, 2 yr, \$15,000.

University of Tennessee. J. S. Davis, Division of Anatomy. Effects of accessory nutritional factors on the nucleic acids of uterine tissue, 2 yr, \$9000.

Virginia Polytechnic Institute. K. W. King, Dept. of Biology. Mechanism of cellulose decomposition by aerobic bacteria, 2 yr, \$6000.

Washington University. M. Cohn, Dept. of Microbiology. Induced enzyme and antibody synthesis, 3 yr, \$22,500.

Washington University. A. Kornberg, Dept. of Microbiology. Enzymatic mechanisms in nucleic acid synthesis, 3 yr, \$26,000.

Western Reserve University. E. W. Sutherland, Dept. of Pharmacology. Mechanism of action of epinephrine and related sympathomimetic amines, 3 yr, \$22,750.

University of Wisconsin. G. W. Keitt, Dept. of Plant Pa-

thology. Nature of parasitism and disease resistance, 2 yr, \$15,000.

University of Wisconsin. F. M. Strong, Dept. of Biochemistry. Chemistry and metabolism of biologically active substances, 3 yr, \$15,700.

Woods Hole Oceanographic Institution. P. F. Scholander, physiologist. Mechanism of gas secretion in fishes, 2 yr, \$8500.

Worcester Foundation for Experimental Biology. R. I. Dorfman. Metabolism of steroid hormones by the guinea pig, 3 yr, \$20,000.

University of California, Berkeley. G. F. Papenfuss, Dept. of Botany. Marine algal flora of South Africa, 3 yr, \$12,250.

University of California, Berkeley. A. E. Pritchard, Dept. of Entomology and Parasitology. Tetranychoid acarids of Europe, 1 yr, \$6500.

Chicago Natural History Museum. C. C. Sanborn, Curator of Mammals. Catalog of the Microchiroptera, 5 yr, \$10,000.

Duke University. R. M. Schuster, Dept. of Botany. Hepaticae of eastern North America, 2 yr, \$7200.

Hollins College. P. M. Patterson, Dept. of Biology. Bryophyte flora of Virginia, 1 yr, \$1000.

Michigan State College. I. W. Knobloch, Dept. of Natural Sciences. Flora of the Barranca Del Cobre Region, 1 yr, \$1700.

New Mexico Highlands University. L. M. Shields, Dept. of Biology. Nitrogen sources and nitrogen content of plants in gypsum, lava, and alkali deserts, 2 yr, \$3450.

Texas A. & M. Research Foundation. S. O. Brown, Dept. of Biology. Microscopic structure of fossil bone, 1 yr, \$2650.

University of Wisconsin. J. T. Medler and S. D. Beck, Dept. of Entomology. Nutrition of plant-sucking Hemiptera, 2 yr, \$6500.

Harvard University. G. R. Willey, Peabody Museum of Archaeology and Ethnology. Prehistoric settlement patterns in the Maya area, 1 yr, \$11,500.

Mount Desert Island Biological Laboratory. W. F. Sheldon. Investigations in general and comparative physiology, 3 yr, \$26,000.

#### *For attendance at international meetings*

Faraday Society. Discussion on Nucleic Acids and Nucleoproteins. E. Chargaff, Dept. of Biochemistry, Columbia University, \$550.

Eighth Pacific Science Congress. M. C. Kik, College of Agriculture, University of Arkansas, \$1300.

Eighth Pacific Science Congress. L. P. Schultz, Takoma Park, Maryland, \$1400.

Eighth Pacific Science Congress. J. Thorp, Dept. of Geological Sciences, Earlham College, \$1550.

#### *For conferences in support of science*

Beloit College. Cosponsored conference on geology research in small colleges, \$2000.

Brown University. R. B. Lindsay. Conference on liquid structure and acoustics, \$7000.

Bryn Mawr College. L. J. Berry, Dept. of Biology. Conference on the place of biological research in the liberal arts college, \$7000.

New York University. H. H. Kendler, Dept. of Psychology. Symposium on problem solving behavior, \$5700.

#### *For education in the sciences*

University of North Carolina. E. A. Cameron, Dept. of Mathematics. Support of summer conference in collegiate mathematics, 8 wk, \$15,000.

University of Oregon. I. Niven, Dept. of Mathematics. Support of summer conference in collegiate mathematics, 8 wk, \$15,000.

Science Service, Inc. W. Davis, Director. Support of Science Clubs of America, 1 yr, \$10,000.

University of Washington. C. D. Allendoerfer, Dept. of Mathematics. Support of summer conference for high school mathematics teachers, 4 wk, \$10,000.

University of Wyoming. E. R. Schierz, Dept. of Chemistry. Support of summer conference in collegiate chemistry, 5 wk, \$10,500.

#### *For policy studies*

University of Chicago. I. Veith, Dept. of Medicine. Study of endowed and grant-supported research in the Division of Biological Sciences of the University of Chicago over the past twenty-five years, 3 yr, \$12,500.

Harvard University. P. G. Frank, Dept. of Physics. Study of reasons for acceptance of scientific theories, 1 yr, \$11,600.

#### *For exchange of scientific information*

University of Chicago. S. Polyak, Dept. of Anatomy. Publication of results of basic research entitled "The Vertebrate Visual System," 4 yr, \$13,300.

Mineralogical Society of America. Publication of expanded issue of *The American Mineralogist*, 1 yr, \$1100.

University of Pennsylvania. I. V. Hellbrunn, Zoological Laboratory. Editing of an international treatise on protoplasm entitled "Protoplasmatologia," \$1000.

New York University. S. A. Korff, Dept. of Physics. Survey of high altitude cosmic ray stations, 2 yr, \$1000.

Smithsonian Institution. S. L. Deignan. Support of "Biological Sciences Information Exchange," 1 yr, \$22,000.

Torrey Botanical Club. E. Lawton, Treasurer. Publication of a 75-year index of the Bulletin of the Torrey Botanical Club, 3 yr, \$5000.

#### *For scientific manpower*

American Institute of Physics. H. A. Barton, Director. Register of scientific and technical personnel in the field of physics, 1 yr, \$14,500.

American Meteorological Society. K. C. Spengler, Executive Secretary. Register of scientific and technical personnel in the field of meteorology, 1 yr, \$9000.

National Bureau of Economic Research. S. Fabricant, Acting Director. Technical study of methods for determining demand and supply of specialized personnel, 1 yr, \$25,000.

Six graduate students from the fields of demography, sociology, conservation, economics, and geography will be chosen for the **Population Reference Bureau's 6-wk Summer Workshop** in Washington, D.C., beginning June 14. Participants will be paid \$50 a week toward transportation and subsistence in Washington for the duration of the session.

*Applications should be submitted before Apr. 1, to Mr. Robert C. Cook, Director, The Population Reference Bureau, 1507 M St., NW, Washington, D.C.* Each application should explain how the student's major interest is related to the population problem and should be accompanied by two supporting letters from professors, instructors, and/or faculty advisers.

## In the Laboratories

The opening of a branch assembly plant and European sales headquarters in Munich, Germany, has been announced by **Beckman Instruments, Inc.**, of South Pasadena, Calif. The new factory will be staffed chiefly by Europeans, with some key personnel transferring from the company's U.S. plants. Production initially will be limited to portable pH meters and quartz spectrophotometers. The address of both the German factory and the European sales headquarters is **Elektron Instrumente G.m.b.H., Gröbenzellerstrasse 13, Munich-Puchheim, Germany.**

The entire operation represents a first step in Beckman's expanded foreign activities, pointing to additional offices in Latin America and the Far East. Overall coordination of Beckman export sales and foreign service is handled by the newly-formed International Division, headed by Robert T. Jones, with headquarters at the main plant at Fullerton, Calif.

A powerful "percolating tea kettle" nuclear reactor has been designed and built by North American Aviation for the U.S. Atomic Energy Commission. The new reactor now is in operation by the **California Research and Development Company**, Livermore, a contractor of the San Francisco Operations Office of AEC. Developing 100 watts, the reactor is unique in that it is the largest unit of its type to operate with a closed cycle, or self-contained system. The tea kettle

or water boiler type reactor, one in which the fissionable uranium compound is contained in a water solution, is so designed that all radioactive by-products of the fission process are retained in the unit instead of being exhausted and mixed with the open air, as in the case of other large reactors of this type. Radioactive by-products in the North American reactor are processed inside the unit and returned to the reactor core. It is possible for the reactor to run for as long as 10 yr without refueling.

The Commercial Solvents Corporation has announced plans for a \$5,000,000 construction and expansion program for the commercial production of nitroparaffins, which heretofore have not been available in volume. The program will consist of new facilities at Sterlington, La., which will account for the major portion of the investment, and enlargement of the company's semi-commercial nitroparaffins operation in Peoria, Ill. The great potential of nitroparaffins lies in their remarkable and versatile abilities as raw materials for producing other chemicals.

## Meetings and Elections

The 47th Annual Meeting of the Air Pollution Control Association, whose headquarters are in Mellon Institute, Pittsburgh, Pa., will be held in Chattanooga, Tenn., May 3-6. Some 600 management executives and other representatives of the industries, research scientists, and air pollution control officials will attend. Thirty-five technical papers will be presented covering the subjects of coal, incineration, petroleum, municipal problems, dusts and fumes, steel, odors, measurements, and meteorology. The last day of the meeting will be set aside for plant inspection trips to study air pollution and control devices.

Six thousand North American biologists will meet in Atlantic City, N.J., Apr. 12-16, to participate in the 38th Annual Meetings of the Federation of American Societies for Experimental Biology. Some 1700 papers covering current researches in physiology, biochemistry, pharmacology and experimental therapeutics, experimental pathology, nutrition, and immunology will be presented in 172 sessions at Convention Hall and the Hotel Dennis.

A joint session, presided over by K. K. Chen, chairman of the Federation Board, will feature reviews by three eminent investigators on such topics as immunization in poliomyelitis, physiology of the thyroid, and addiction to narcotics. Throughout the week special sessions, symposia, and panel discussions will direct attention to teaching principles and techniques in research training, clinical medicine, and medical practice. Developments in neurophysiological research will be treated in a discussion-display session, and "frontiers" in biochemistry will be informally presented by recent Nobel Prize winners.

Industrial exhibits of books, chemicals, pharmaceuticals, foods, equipment, and apparatus will be located in the main areas of Convention Hall. These

will include some displays that amplify papers presented in scientific sessions.

The Federation Placement Service will operate a clearing-house during the Meetings to facilitate interviews between persons seeking positions and representatives of institutions or industrial firms that wish to fill vacancies.

The 1954 Eastern States Health Education Conference of the New York Academy of Medicine will be held at the Academy on Apr. 29-30. The program will include four sessions and an evening dinner meeting. The subject of this year's conference will be "Communication in health education." Among the contributors to the conference are William McPhee and Elihu Katz of Columbia University's Bureau of Applied Social Research, Louis Hacker of the School of General Studies at Columbia University, Leo Lowenthal of the U.S. State Department's Voice of America, Shirley A. Star of the National Opinion Research Center at the University of Chicago, and Earl Lomon Koos of the School of Social Welfare at Florida State University.

A workshop session on the concepts of communication will be held in conjunction with the meeting. Participation in the Conference is limited. Those interested should write to Dr. Iago Galdston, The New York Academy of Medicine, 2 E. 103 St., New York 29.

The Division of Chemical Education of the American Chemical Society has announced the following three summer conferences:

**Fifth General Chemistry and First Organic Chemistry Conference (Workshop), Eastern Session, North Carolina State College, Raleigh, June 16-26.** Programs are being planned for both college and secondary school teachers. Colored teachers of chemistry are invited. Douglas Nicholson is the director for the ACS Division of Chemical Education. Information and requests for registration should be directed to Dr. Walter J. Peterson, Head, Department of Chemistry, North Carolina State College, Raleigh.

**Fifth General Chemistry Conference (Workshop), Kenyon College, Gambier, Ohio, June 25-July 2.** Although this program is planned for the college and secondary school teachers in those institutions participating in the School and College Study of Admission with Advanced Standing, the Conference will be similar to the previous workshops, and teachers not involved in the program are encouraged to attend. This Conference is supported in part by the funds allocated to the afore-mentioned study. Edward Haenisch is the director for the ACS Division of Chemical Education. Information and requests for registration should be directed to Dr. Bayes Norton, Kenyon College, Gambier, Ohio.

**First Chemistry Institute, University of Wyoming, Laramie, June 12-Aug. 20.** This 5-wk Institute will take the place of the Fifth General Chemistry Workshop for the Western United States. The program will be devoted to recent advancements in chemistry, with

particular attention to the needs of the teachers in the 4-yr and junior colleges. Emphasis will be placed on the teaching problems of general, analytical, and organic chemistry. This Institute is being sponsored by the National Science Foundation and funds are available to assist a number of chemistry teachers to attend. Information may be obtained from Dr. E. H. Schierz, Head, Department of Chemistry, University of Wyoming, or Dr. Otto M. Smith, Chairman, Committee on Teaching of College Chemistry, Oklahoma A. & M. College, Stillwater.

The USA National Committee of the **International Scientific Radio Union (URSI)** and the **Institute of Radio Engineers Professional Group on Antennas and Propagation and Microwave Theory and Techniques (PGMTT)** are jointly sponsoring a meeting at the National Bureau of Standards, Washington, D.C., May 3-6. A combined technical session of interest to all participants is scheduled for the morning of May 4, to be followed by one or more sessions in each of the following fields: radio measurement methods and standards; tropospheric radio propagation; ionosphere radio propagation; terrestrial radio noise; radio astronomy; radio waves and circuits, including general theory; antennas; electronics.

A symposium on millimeter waves, planned jointly by the PGMTT and URSI Commission 6, will be a feature of the meeting. Additional details and registration blanks are available from the secretary of the USA National Committee, W. E. Gordon, School of Electrical Engineering, Cornell University, Ithaca, N.Y.

**Phi Lambda Upsilon** has elected the following officers for 1954-57: pres., James M. Church, Department of Chemical Engineering, Columbia University; v. pres., Carl S. Carlson, Morton Salt Co., Chicago, Ill.; sec., Thomas B. Cameron, Department of Chemistry, University of Cincinnati; treas., William B. Schrenk, Department of Chemistry, Kansas State College.

Plans have now been completed for the **1954 Southern Industrial Wastes Conference** to be held in Houston, Tex., Apr. 21-23. The program is jointly sponsored by the Southern Association of Science and Industry, the Texas Chemical Council, and the Manufacturing Chemists' Association. Presiding officers will be A. P. Black, president of the Southern Association of Science and Industry; William C. Foster, president of the Manufacturing Chemists' Association, and J. D. Harper, president of the Texas Chemical Council. L. L. Hedgepeth of the American Cyanamid Company is chairman of the Conference.

The 30th annual meeting of the **Southwestern Division of the AAAS** will be held on Apr. 25-29 in Lubbock, Tex., on the campus of the Texas Technological College. Meetings to present papers reporting original investigations will be held by the botanical, physical, social, and zoological science sections. In addition,

there will be numerous symposia in such varied fields as instrumentation, ground waters, and desert and arid region problems. On Monday evening the annual **John Wesley Powell Memorial Lecture**, honoring the noted explorer of the Grand Canyon of the Colorado River, will be given on "A new era in human understanding" by Roger J. Williams, professor of chemistry and director of the Biochemical Institute of the University of Texas. Through the courtesy of the local chapter of Sigma Xi, the Division has arranged for a talk by Henry Eyring, dean of the Graduate School of the University of Utah, on "Nonlinear departures from equilibrium." During the meeting, participants are invited to view a number of exhibits in the museum, the most interesting of which is the display of 26 models of Leonardo da Vinci's mechanical inventions. Field trips are always an important part of these meetings. This year Frank Blair, president of the Southwestern Association of Naturalists (SWAN), has offered the services of SWAN in the organization and sponsoring of field trips for the entire meeting.

Joining with the Division in this meeting are the Texas Academy of Science, the Oklahoma Academy of Science, the Southwestern Association of Naturalists, and a number of other local and regional groups. Now that part of Wyoming and Montana are included in the Division, a goodly representation from these states is expected and several interesting papers from them have already been promised. With this recent expansion of territory, it seems appropriate that the Division's name be changed to something like "Southwestern and Rocky Mountain" or "Desert Range and Rocky Mountain." Suggestions for a new name will be appreciated.

As is always the case, papers by both members and nonmembers are solicited and residence in the area is not a requirement. It is hoped that programs will be distributed by Apr. 18. Titles and abstracts arriving too late for inclusion in the regular program will be placed on a supplementary program that will be presented if time permits. Inquiries should be directed to Frank E. E. Germann, Executive Secretary, Boulder, Colo.

The 502nd meeting of the **American Mathematical Society**, which will include a **Symposium in Applied Mathematics** sponsored by the Society and the Office of Ordnance Research, will be held at the University of Chicago Apr. 29-May 1. The symposium will consist of three sessions under the chairmanship of L. E. Simon, T. J. Killian, and W. W. Leutert. The subjects to be covered are operations research, probability theory, statistics, numerical analysis, elasticity, and differential equations. Addresses will be delivered by P. M. Morse, Jerzy Neyman, J. E. Mayer, H. O. Hartley, M. R. Hestenes, A. A. Bennett, C. A. Truesdell, J. J. Stoker, Florent Bureau, William Feller, and John Todd. By invitation of the Committee to Select Hour Speakers for Western Sectional Meetings, S. C. Kleene will address the Society. For further details write to J. W. T. Youngs, Bloomington, Ind.

# Technical Papers

## Oxygen Protection against Ionizing Radiations<sup>1</sup>

C. S. Bachofer and M. Aelred Pottinger<sup>2</sup>

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University of Notre Dame, Notre Dame, Indiana

No clear-cut case of protection of organisms against ionizing radiations by oxygen has ever been reported. Numerous reports have indicated a sensitization to ionizing radiations in the presence of oxygen, with a corresponding protection against these radiations in an oxygen-free environment. Some reports have indicated that oxygen is without effect. The literature is summarized by Patt (1), with explanations of the most probable mechanisms involved. Alper (2) has reported that during x-irradiation of oxygen-free suspensions of phage S13, inactivation proceeded initially at a rate

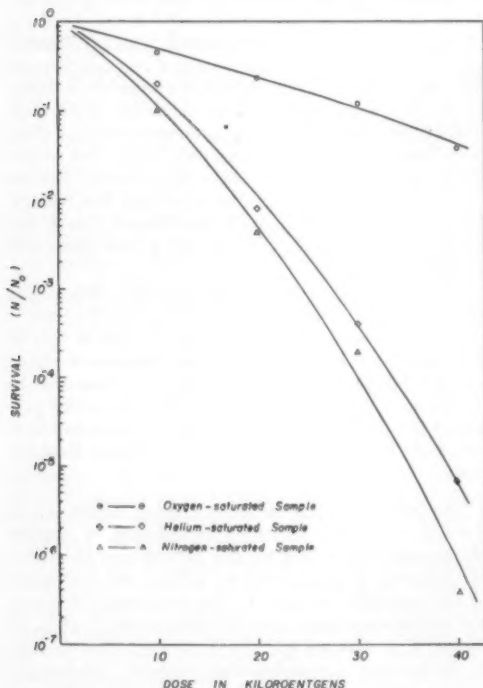


FIG. 1. Survival of bacteriophage T1 plotted as a function of dose of x-rays. The viruses were suspended in saturated solutions of oxygen, helium, and nitrogen.

<sup>1</sup> A part of the research performed under Contract No. AT(11-1)-205 between the Atomic Energy Commission and the University of Notre Dame.

<sup>2</sup> We express gratitude to Professor Milton Burton of the Radiation Chemistry Project at Notre Dame for use of the cobalt-60 gamma source.

TABLE 1. Survival ( $N/N_0$ ) of bacteriophage T1 in inorganic salt solutions after exposure to cobalt-60 gamma radiation. The viruses were irradiated in sealed glass vials for 8 min. The dose rate was 4300 r/min, giving a total dose of 34,400 r, as determined by the ferrous ammonium sulfate method.

Solution		Oxygen-rich	Oxygen-free
$(\text{NH}_4)_2\text{SO}_4$	1 M	$3.1 \times 10^{-1}$	$2.3 \times 10^{-4}$
	$10^{-2}$ M	$4.1 \times 10^{-1}$	$3.2 \times 10^{-4}$
$\text{NaNO}_3$	1 M	$6.1 \times 10^{-1}$	$4.0 \times 10^{-1}$
	$10^{-2}$ M	$5.8 \times 10^{-1}$	$5.3 \times 10^{-1}$
	$5 \times 10^{-4}$ M	$6.0 \times 10^{-1}$	$5.2 \times 10^{-1}$
$\text{NH}_4\text{NO}_3$	1 M	$4.3 \times 10^{-1}$	$7.7 \times 10^{-1}$

which was certainly no slower than that observed in aerated suspensions, whereas the inactivation rate became greater in aerated suspensions when reaction with  $\text{H}_2\text{O}_2$  became perceptible.

In the present research, bacteriophage T1, specific for *Escherichia coli*, strain B, was irradiated in an aqueous medium made rich with oxygen by bubbling pure oxygen through the suspending medium, or in a medium depleted of oxygen by bubbling purified nitrogen through the medium. The stocks of T1 had been grown in a chemically defined medium utilizing lactic acid as the only organic source of carbon. The cell-free lysates were adjusted so that they contained  $3 \times 10^{10}$  particles/ml. The suspension prepared for irradiation consisted of a  $5 \times 10^{-3}$  concentration of this lysate in doubly distilled water. All surviving fractions of irradiated phage,  $N/N_0$ , represent the ratio of the number of irradiated survivors to the number of phage particles treated in all respects exactly the same, except for irradiation. Dilution and plating procedures followed the methods outlined by Adams (3).

Typical results for 100-kvp x-rays, filtered by 5 mm equivalent of aluminum and 1 mm of Pyrex glass, are depicted in Fig. 1. The dose rate was adjusted to 1000 r/min, the dose was determined by the oxidation of ferrous ammonium sulfate (4); 40 min constituted the longest irradiation period. To check the possibility of harmful or protective components in either the nitrogen or the oxygen, all experiments were run in triplicate with two different sources of nitrogen and oxygen, and, as a further precaution, helium was substituted for nitrogen in a series of three experiments. The results with helium show effects of the same order of magnitude as with nitrogen. Although slightly higher, the results are not considered significantly different. The order of magnitude of the results appears to preclude the possibility that at higher doses the rate of inactivation in the presence of oxygen might proceed at a rate even approaching that in the absence of oxygen.

The phenomenon has been further verified by irradiation with cobalt-60 gamma rays of phage suspensions in distilled water and in a large number of solutions

of inorganic salts. In the tests utilizing inorganic salts, which were added singly to the phage-water suspensions in various concentrations, it has been possible to obscure the oxygen effect or to bring it out sharply, as indicated in the few examples given in Table 1. A discussion of the implications involved with the salts will be presented in detail later.

The results of these experiments raise questions of fundamental importance in radiation biology: Is this effect specific for bacteriophage T1, or is the basic phenomenon reported here obscured in organisms of more complex organization? Does the presence or absence of oxygen alter the phage particles in some way, or is the effect to be explained in terms of suppression or enhancement of certain products of irradiated water? These and related problems are under consideration.

#### References

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## Adrenocorticotrophic Activity of Nonmammalian Origin

John W. Nelson, Paul W. O'Connell, and William J. Haines

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In the course of establishing the specificity of their now standard bioassay for the adrenocorticotrophic hormone (ACTH), Sayers, Sayers, and Woodbury (1) administered extracts of liver, brain, and spleen of hypophysectomized rats without affecting the adrenal ascorbic acid concentration of the assay animals. Subsequently, Richards and Sayers (2) found that the kidney of intact rats contains a substance which depletes the adrenal ascorbic acid content of hypophysectomized rats. They also found that the kidney accumulates hormonal activity following intravenous administration of rat ACTH. Jailer and Knowlton (3) and Opsahl and Long (4) have presented evidence, including measurements of adrenal ascorbic acid depletions, for the presence of a type of ACTH activity in human placenta. The presence of adrenal ascorbic acid depleting activity in human placenta was confirmed by one of us (JWN). Recently, it has been observed in this laboratory that ACTH-like activity is present in extrapituitary, nonmammalian sites. About 140 source materials, mostly of microbial origin, have been examined,<sup>1</sup> and we wish to report one of the most interesting developments at this time.

This study was initiated as a result of the finding that the administration to hypophysectomized rats of a 1 mg/100 g body weight dose of an antibiotic feed supplement derived from bacitracin fermentation resi-

dues<sup>2</sup> caused a significant depletion of adrenal ascorbic acid concentration. On successive days, average depletions of 84 and 80 mg of ascorbic acid/100 g adrenal tissue were obtained; five rats were employed in each assay.<sup>3</sup>

That there was a chemical resemblance between the ACTH-like activity found in the feed supplement and the pituitary hormone was indicated by the fact that the activity could be extracted and concentrated by the acid-acetone method of Lyons (5). This is probably the most commonly employed method for extraction and initial purification of pituitary ACTH. The acid-acetone powder so obtained could then be fractionated with ammonium sulfate to achieve a tenfold concentration of activity.

The ACTH-like activity of the feed supplement was not due to bacitracin polypeptides, judging by the fact that fractions representing stages of increasing bacitracin purity were less potent in adrenal ascorbic acid depletion. When it was noted that an approximately quantitative extraction of the activity from the source material could only be achieved when the solids were first autoclaved with dilute sulfuric acid (a procedure that does not inactivate mammalian ACTH) prior to the acetone treatment, it seemed probable that the ACTH-like activity might be associated with the bacterial organism of the fermentation. Consequently, it was decided to examine some isolated bacterial cells for ACTH-like activity.

**Procedure.** The organism to be studied was transferred from a stock culture to 100 ml of beef-extract-peptone broth and placed in an incubator at 37.5° C for 1 day. An aliquot (1 or 2 ml) of suspended growth was transferred to 200 ml of fresh broth, and the incubation was continued 4 to 5 days. The cellular material was then collected by centrifugation and suspended in dilute sulfuric acid (0.01 or 0.1 normal), employing 3 to 10 vol of acid per volume of packed cells. The resulting suspension was autoclaved at 15 lb pressure for 20 min. After cooling, the suspension was centrifuged, and the supernatant solution was administered in the Sayers bioassay at 0.5 ml/100 g body weight.

In this bioassay, one adrenal is first removed from the test animal (a hypophysectomized rat) prior to the administration of the sample to be tested. The test dose is then administered and, after a suitable time interval, the paired adrenal is removed. Ascorbic acid determinations are then performed on each adrenal, and the depletion resulting from the substance administered is the difference in concentration of ascorbic acid between the animal's own adrenals.

**Results.** The data obtained from the bioassays are presented in Table 1.

In interpreting these data, the following considerations should be kept in mind: (a) In our experience, administration of acidified saline solution, as employed

<sup>1</sup> We are indebted to Dr. W. G. Bywater, of the S. B. Penick Co., who provided the spray-dried residues obtained from filtration of the fermentation broth.

<sup>2</sup> We wish to thank S. C. Lyter and his group for the bioassays. John Karnemaat assisted in the bacteriological work.

TABLE 1. Adrenal ascorbic acid depletions by bacterial extracts.

Organism	Ratio: vol sus- pending fluid/ vol packed cells	Depletion in mg/100 g adrenal tissue		
		Individual values	Av	
<i>Bacillus licheniformis</i> *	3	159, 162, 85, 112, 129	129	
<i>Bacillus subtilis</i> (rough)	4	135, 129, 136, 122, 102	125	
<i>Serratia marcescens</i> (pigmented)†	3	116, 71, 67, 110	91	
<i>Lactobacillus leich-</i> <i>manii</i> , 7830‡	10	131, 77, 60, 100	92	
<i>Escherichia coli</i> , 9637	10	63, 55, 106, 82	77	

\* Bacitracin-producing strain.

† Grown at room temperature.

‡ Required 100 mg Tween 80 (Atlas Powder Company) per 100 ml broth for growth.

in diluting samples for the Sayers assay, may result in adrenal ascorbic acid depletions up to 40 mg/100 g. (b) As a result of extensive collection of data by our bioassay group, an average depletion of 60 mg/100 g adrenal tissue may be estimated to represent about 0.1 milliunit (U.S.P. provisional standard) of ACTH activity and represents a minimum value acceptable for quantitative estimation. (c) The depletions reported in Table 1 were measured at only one dosage level, frequently without accompanying standards. For these reasons, we have regarded average depletions of less than 70 mg/100 g of adrenal tissue as of doubtful significance. Thus, *Mycobacterium smegmatis*, in 3 vol of suspending fluid, gave a depletion of 54 mg/100 g tissue. The nonpigmented form of *S. marcescens* was definitely without activity when tested at the same dilution as its pigmented variety. Similarly, *L. casei* was inactive under conditions comparable to those under which *L. leichmanii* demonstrated its activity.

Since some of the bacteria first examined and found to produce the ACTH-like activity were also known producers of vitamin B<sub>12</sub>, a single experiment was carried out to determine whether other recognized sources of the vitamin might also yield the ACTH response. A 5-g portion of sardine fish meal was autoclaved in 100 ml of 0.1 normal sulfuric acid and the insoluble residue was removed by centrifugation. The supernatant solution was adjusted to pH 2.2 with sodium bicarbonate and was administered to three hypophysectomized rats at 0.5 ml/100 g body weight. Adrenal ascorbic acid depletions of 109, 103, and 71 mg/100 g of adrenal tissue (av, 94) resulted. The activity is not due to the vitamin itself, as was found by administering a B<sub>12</sub> concentrate. Whether there is some relationship between the vitamin and the hormonal activity of these nonmammalian sources is not known at this time.

The small quantities of low-purity material that have been available have not permitted an independent characterization of the ACTH activity to establish whether or not all the physiological properties of the pituitary hormone are reproduced. In a further survey of the specificity of the Sayers procedure, however, it was found that neither *d*-carvone nor *dl*-dihydroxyphenylalanine, compounds having a relationship to ascorbic acid metabolism (6, 7), caused any depletion at a dosage of 5 mg/100 g body weight.

On the basis of the data obtained by the Sayers procedure and of the similar chemical behavior of the observed active principle to pituitary ACTH, we suggest that there is present in various nonmammalian organisms, particularly bacteria, a constituent possessing adrenocorticotrophic activity.

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#### Effect of Hypoxia on DNA Synthesis in the Bone Marrow and Spleen of the Rat<sup>1</sup>

W. A. Rambach, J. A. D. Cooper,<sup>2</sup>  
and H. L. Alt

Departments of Medicine and Biochemistry,  
Northwestern University Medical School,  
Chicago, Illinois

The constancy of the deoxyribonucleic acid (DNA) content of nuclei in cells of a given species (1) permits the use of DNA phosphorus (DNAP) as a measure of cellularity of the bone marrow and spleen. The rate of synthesis of DNA which may be estimated from the incorporation of radiophosphorus into the DNAP may be employed as an index of mitosis rate (2). In the present investigation, these techniques have been applied in a study of the effects of hypoxia on the cellular activity of the bone marrow and spleen.

Sprague-Dawley strain male rats, 3 to 4 mo old with an average weight of 264 g, were used. The rats were injected intraperitoneally with 2  $\mu$ c of carrier-free NaH<sub>2</sub>P<sub>32</sub>O<sub>4</sub> per 100 g of body weight and sacrificed 4 hr later.

<sup>1</sup> This study was supported in part by funds provided under contracts AF 33 (038) 17751 between the USAF School of Aviation Medicine, Randolph Field, Texas, and AT (11-1) 94 between the U.S. Atomic Energy Commission and Northwestern University, and was aided by a grant from the Armour Laboratories.

<sup>2</sup> Markle Scholar in Medical Science.

<sup>3</sup> Obtained on allocation from the U.S. Atomic Energy Commission.

TABLE 1. Influence of 30 hr of intermittent hypoxia on the phosphorus fractions of the bone marrow and spleen.

Group	No. of animals	Phosphorus content mg/g tissue		Specific activity*	
		ASP†	DNAP	ASP	DNAP
Bone marrow					
Control	15	0.966	1.320	0.481	0.199
σ‡		± 0.088	± 0.295	± 0.064	± 0.034
30-hr hypoxia	6	1.059	1.458	0.608	0.383
σ		± 0.070	± 0.116	± 0.078	± 0.086
P§		< 0.98	< 0.80	> 0.99	> 0.99
Spleen					
Control	15	0.969	1.294	0.468	0.034
σ		± 0.107	± 0.244	± 0.011	± 0.002
30-hr hypoxia	6	0.949	1.454	0.676	0.287
σ		± 0.020	± 0.112	± 0.080	± 0.036
P		< 0.50	< 0.90	> 0.99	> 0.99

\* Percentage of dose of  $P^{32}$  injected/mg. P in fraction.

† Acid-soluble phosphorus.

‡ Standard deviation of the mean.

§ Probability.

Animals were subjected to hypoxia in a low-pressure chamber at an oxygen concentration of 7.75 percent. The methods of obtaining marrow and spleen samples, the tissue fractionation procedures, and the counting techniques have been described (3, 4).

The data on 15 control animals and 6 animals subjected to intermittent hypoxia for 10 hr a day for 3 consecutive days are presented in Table 1. The experimental animals were injected with radiophosphorus 15 hr after return to ground level. There was no weight loss during the experimental period.

Striking changes were found in the specific activity of the DNAP in the bone marrow and spleen. Hypoxia produced a stimulation of mitosis in both organs. The specific activity in the spleen reached 8 times that of the control, while there was a doubling of the control value in the bone marrow.

Although there was not a marked change in the DNAP concentration or cellularity in either organ, the increase in total erythropoietic mass in the spleen was notable. The spleen weights of animals exposed to 30 hr of intermittent hypoxia increased 175 percent. Taken together with the 500 percent increase in the cells of the erythropoietic series observed in the differential counts from the spleen imprints, an almost tenfold increase in the total erythropoietic tissue resulted from the increased mitotic rate following the hypoxic stimulus.

Unlike the spleen, which may increase in size to accommodate a larger number of cells, the bone marrow is restricted to the marrow cavities, which in the rat are almost entirely filled with red marrow. This would be expected to prevent large increases in the total number of cells. The small increase found was due almost entirely to hyperplasia of the red cell series. The importance of the spleen in the erythro-

poietic response to hypoxia in the rat is clearly shown by these experiments.

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### Detection of Microbially Produced Gaseous Hydrocarbons Other than Methane

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Attempts to detect microbially produced gaseous hydrocarbons other than methane have usually failed. Notable exceptions are reports of ethylene being formed by fungi (1, 2). Where other gaseous hydrocarbons such as ethane have been reported there has usually been a question of the actual source, due to the use of municipal sewage in experiments, for example.

Buswell (3) states that efforts to detect gaseous hydrocarbons other than methane in microbial fermentations in his laboratory have failed. Furthermore, in data furnished to him by A. V. Grosse (3) and reported at the 113th Meeting of the American Chemical Society but not included in the abstract (4), a mass spectrometer analysis of purified sewage gas indicating 99.2 percent methane failed to reveal ethane or propylene. The limit of sensitivity in the measurement was 20 ppm for those gases.

By increasing sensitivity still further to the order of 0.05 ppm, we have detected numerous gaseous hydrocarbons other than methane produced in microbial fermentations, and also by the fungus, *Penicillium digitatum* A.T.C.C. No. 10030, growing upon potato-glucose agar. Details of the modification of a Westinghouse Type LV mass spectrometer to obtain high sensitivity will be reported elsewhere.

For hydrocarbon measurements in the parts per million range, the  $C_2$  and heavier hydrocarbons were condensed in a trap at liquid nitrogen temperature while the major portions of noncondensable atmospheric gases and methane were pumped off and discarded. Carbon dioxide was removed by KOH absorption. The trapped  $C_2$  and  $C_3$  hydrocarbons were admitted to the mass spectrometer through a trap at  $-155^\circ C$ , which retains most of the  $C_4$  and all the heavier hydrocarbons. The use of 500-ml samples of microbially produced gas permitted measurements of individual  $C_2$  and  $C_3$  hydrocarbons to within  $\pm 0.05$  ppm of total sample.

Cow dung was selected as an inoculum free from

<sup>1</sup> Acknowledgment is due J. P. Stanley for his assistance in the performance of experiments.

TABLE 1. Analyses of gas collected over the microbial fermentation of paper.

Component measured*	Concentration†	
	Dec. 5, 1951	Feb. 7, 1952
Nitrogen	21.7 mole %	3.48 mole %
Oxygen	2.0 " "	1.38 " "
Argon	0.13 " "	0.07 " "
Carbon dioxide	33.7 " "	46.9 " "
Methane	42.6 " "	49.0 " "
Ethane	3.2 ppm	7.0 ppm
Ethylene	3.9 " "	4.7 " "
Propane	0.14 " "	0.06 " "
Propylene	0.13 " "	0.21 " "

\* Nitrogen gas was used to flush the system initially. Although the presence of oxygen and argon suggests atmospheric contamination of the samples in handling, air has been found generally to contain only a few parts per billion of gaseous hydrocarbons other than methane.

† Hydrogen-free basis.

petroliferous contamination. A portion of the inoculum was mixed with mineral salts medium and paper (Nu-wipe tissue) in a Waring Blendor; this mixture was then added to a 20-liter bottle filled almost to capacity with freshly boiled and cooled mineral salts medium. Tank nitrogen was passed through the liquid for ½ hr to flush oxygen from the system. Analysis of the gas formed as a result of microbial fermentation for several weeks is given in Table 1.

Aliquots from the digested sludge in the 20-l bottle were added to liter quantities of 1 percent ethanol, sodium acetate, sodium butyrate, and glucose, respectively, in mineral salts medium. Active fermentation ensued in all cases at a much greater rate than the digested sludge alone. The ethanol fermentation yielded the most methane, 90 percent. Gas issuing from each of the fermentation systems was collected and analyzed in five successive 500-ml increments.

Ethane was found in all gas samples. The largest quantities were produced by the ethanol fermentation where concentrations increased from 1.2 ppm in the first gas increment to 6.8 ppm in the fourth increment. Ethane concentrations in gas from the glucose fermentation also increased from 0.1 ppm in the first gas increment to 0.7 ppm in the fifth increment. All gas samples from the acetate and butyrate fermentation systems contained about 0.2 ppm ethane. Ethylene was found in the gas from the ethanol and glucose fermentations in concentrations ranging from 0.1 to 2.6 ppm. It was also present in early gas samples from the acetate and butyrate fermentation systems but disappeared in the gas samples collected later. Acetylene was present in all gas samples from both the butyrate and acetate fermentation systems in a concentration of approximately 0.2 ppm. It was also detected in gas from the glucose fermentation system at an intermediate stage of the fermentation, but no acetylene was detected in gas from the ethanol fermentation system.

There were no C<sub>3</sub> hydrocarbons found in gas from the acetate or ethanol fermentation systems. Propylene was present, 0.9 and 0.4 ppm, respectively, in the first

gas increments from the butyrate and glucose fermentation systems, but its concentration decreased to 0.0 ppm in the fourth gas increments. The fifth gas increment from the glucose system contained 0.1 ppm of propane. Propane could not be positively identified in any of the other samples.

Using a different source of microbial inoculum, namely 100 ml of municipal sewage sludge, fermentation of paper and 1 percent ethanol in a mineral salts medium was carried out. The system used was a stainless steel 8-l tank fitted with a pressure gage. The tank was thoroughly evacuated after the addition of 4 l of the ethanol medium containing 5 g of homogenized Nu-wipe tissue. Pressure began to increase in the fermentation system after about 2 wk and was allowed to reach 45 psi above atmospheric pressure. The gas formed consisted of approximately 20 percent carbon dioxide and 80 percent methane. Ethane and acetylene were each found in a concentration of 0.3 ppm and ethylene was found in a concentration of 0.1 ppm. Propane and propylene were absent.

*Penicillium digitatum* A.T.C.C. No. 10030 was grown upon potato glucose agar in desiccators, and the atmosphere, which initially consisted of 20 percent tank oxygen and 80 percent tank nitrogen, was analyzed. The principal gas constituents were found by mass spectrometer analyses to be carbon dioxide and nitrogen; however, gaseous hydrocarbons were detected as in the bacterial fermentation systems. Thus, acetylene concentrations ranged from 0.0 to 0.6 ppm, ethylene, 0.2 to 1.4 ppm, propylene, 0.0 to 1.2 ppm, ethane, 0.1 to 0.6 ppm, and propane, 0.0 to 0.1 ppm, respectively. None of these components could be identified in a control system where *Penicillium digitatum* inoculum was omitted.

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## The Quantification of Hostility in Dreams with Reference to Essential Hypertension

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In investigating methods for the measurement of emotional forces, a preliminary hostility scale was derived from a content analysis of 500 manifest dreams obtained from 200 subjects presenting wide variation in personality structure (1). This scale was found to differentiate hypertensive from nonhypertensive subjects.

Although most of the studies using dream material

have been chiefly concerned with uncovering the latent dream thoughts, the highly characteristic nature of the manifest dream for each person was observed by Freud (2) and corroborated by others, for example, Hall (3) and French (4). Although unique for each individual, the manifest dream seems to reveal similarities in those suffering from certain disease processes (5).

**Hostility scale.** In our material, hostility seemed present in greater intensity in the manifest dreams of hypertensives than in those of normotensives, and its presence in this degree can be used to distinguish the former from the latter. A 6-point scale to measure hostility has been constructed, demarcating three major categories in the intensity of its expression. The determination of the degree of hostility was arrived at on the basis of clinical experience. Each dream is broken up into what Freud has termed "conceptual elements" (similar to the independent clauses of sentences) which are scored individually and then totaled to give the hostility rating for the dream—any dream element that represents the actual or threatened: death of persons, receives a rating of 6; destruction of objects, 5. Such acts or scenes fall within the maximum category. In the medium category fall any elements that represent actual or threatened injury or damage—to persons, rated as 4; to objects, 3. The minimum category includes all elements that represent discomfort or minor impairment—to persons, rated as 2; to objects, 1.

**Testing the scale.** The scale was tested on 78 dreams obtained from 33 subjects, 17 of whom were chronic hypertensive patients from the Hypertensive Clinic of the Hospital of the University of Pennsylvania, and 16 of whom were normotensive summer school college students. Each subject provided at least two dreams of at least 30 words. The average length of the dreams was about 65 words, and there was no significant difference in length between the patients and the controls. The dreams of patients had to be collected by interviews with an experienced social worker, whereas control dreams were written out by the subjects on a standard questionnaire form. All dreams were dreamed within a period of 2 mo from the time of collection. Neither patients nor controls were aware of the purpose of the work.

Three judges were trained in the use of the scale. All three were second-year medical students at the University and were unaware of the purpose of the study. Hostility scores for each dream were computed by each judge and the rank difference correlations between the three were .83, .84, and .85, all significant at better than the .001 level.

Hostility scores for each dreamer were then computed as a mean score taken from the averaged scores given each dream by the three judges. The difference between the means of the hypertensive group and the control group was significant at better than the .001 level by the *t*-test appropriate for two samples where *F* is also significant.

**Discussion.** This series is limited by the fact that

the control and experimental groups are not adequately random or well matched. The uncontrolled variables that merit further study include age, race, health, and socio-economic status. It is also recognized that hostility is significant in other psychosomatic illnesses. It is felt that this pilot work is encouraging and that further refinement and use of the hostility scale, plus measures of other emotional forces, now in varying stages of development, may contribute: a method for the quantitative study of emotional forces; further understanding of essential hypertension and other psychosomatic illnesses; possible applications to diagnosis, therapy, and prevention.

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## The Effectiveness of 2,4,5-Trichlorophenoxyacetic Acid in Reducing Drop and Promoting Growth of Frosted Apricot Fruits<sup>1</sup>

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A marked increase in resistance of apricot fruits to low-temperature injury was obtained by the application of an aqueous solution of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) about 15 hr before the occurrence of a frost. In addition, severely frosted fruits, in which the ovules were killed and, in some cases, the endocarp tissue was injured, were induced to grow to normal size by a single application of 2,4,5-T, made either before or 2 days after the frost occurred.

As a continuation of a research program regarding the effects of 2,4,5-T on fruit size and maturity (1, 2), six trees each of the Royal and Derby varieties were sprayed with a 100-ppm solution of the trialkylamine salt of 2,4,5-T at Winters, Calif., the afternoon of April 8, 1953. At the time of spraying, approximately 40 days after full bloom, the pit apices in the fruits were just beginning to harden, and endosperm development had progressed to about 1 mm in length.

The morning of April 9, a radiation frost occurred in the Winters area, and the temperature, as recorded in a standard weather shelter, was 32° F for 3 hr and 31° F for 1 hr. An examination of both sprayed and unsprayed fruits a few hours after the frost revealed considerable blistering of the skin, particularly

<sup>1</sup>Appreciation is expressed to the Dow Chemical Company for supplying the 2,4,5-T used in this investigation.

TABLE 1. Effect of 2,4,5-T (100 ppm) application to the Royal apricot about 15 hr before the occurrence of a frost on subsequent fruit drop and embryo development in the fruit that matured.

Treatment	Fruit that dropped (%)	Fruit at time of spray application	
		Maturing with aborted or partially developed embryos (%)	Maturing with normal embryos (%)
2,4,5-T	12.3	21.7	66.0
Control	76.2	1.8	20.0

of those fruits exposed to the sky and not shielded by foliage. Extensive brown spotting of the integuments also was found to have occurred, a characteristic symptom of low-temperature injury.

To check the possibility that the 2,4,5-T spray applied the afternoon before the frost might have an effect on fruit drop, large branches, each bearing approximately 200 fruits, on three sprayed and three adjacent unsprayed trees, were selected with regard to uniformity of position on the tree and exposure to the sky. These branches were tagged, and the fruits were counted.

Three weeks after the occurrence of the frost, 69.5 percent of the fruit had dropped from the unsprayed Royal branches, whereas only 1.3 percent had dropped from the sprayed branches. At the time of harvest, fruit counts indicated that 76.2 and 12.3 percent of the fruit had dropped from the unsprayed and sprayed branches, respectively (Table 1). The data for the Derby variety were similar to those for the Royal; 5.7 and 70.6 percent of the fruit had dropped before harvest from the sprayed and unsprayed branches, respectively.

The fruits remaining on the branches were harvested when mature, their pits removed, and the condition of their embryos noted. Of these, fruits with aborted or partially developed embryos accounted for 21.7 percent of the original number on the sprayed branches and only 1.8 percent on the unsprayed branches (Table 1). In the former case, 2,4,5-T prevented the abscission of the major portion of the frost-damaged fruit.

More significant than this, however, was the apparent increase in resistance of the ovules to low temperature as a result of 2,4,5-T treatment. Of the fruits on the sprayed branches at the time of 2,4,5-T application, 66 percent reached maturity with normally developed embryos (Table 1). In contrast, only 20 percent of the fruit on the unsprayed branches at the time at which 2,4,5-T was applied reached maturity with normally developed embryos (Table 1). Thus, the sprayed branches not only dropped 83.9 percent less fruit than the unsprayed, but they also produced 69.7 percent more fruit with normally developed embryos.

The mechanism of this action in increasing resistance to low temperature is not understood but, perhaps, may be attributed to an increase in sugar concentration of the cell sap. A pronounced increase in total sugar content, both sucrose and reducing sugars, has been found to take place in apricot fruits shortly after the application of 2,4,5-T (3). It is of interest to note that Corns (4) recently reported an improvement in frost resistance of parsnip tops subsequent to the application of either 2,4,5-trichlorophenoxypropionic acid or sodium naphthaleneacetate. Prior to frost, he reported, these chemicals retarded growth of the main fleshy root. As a result of restricted root growth, soluble carbohydrate accumulation may have taken place in the top, so that consequently a lower temperature was needed to bring about injury.

A count of the total number of fruits on each of the sprayed and unsprayed Royal trees when harvested indicated that the former averaged 3500 fruits per tree, as compared with 1200 fruits for the latter. Even though 3 times the number of fruits matured on the sprayed as on the unsprayed trees, diameter measurements of a random sample of 100 mature fruits from each of the six trees per treatment indicated a difference of only 1.5 mm in favor of the unsprayed fruits. In view of the great difference in size of the crop produced by the sprayed and unsprayed trees, the former would be expected to produce smaller fruits than the latter. The application of 2,4,5-T to the apricot, however, has been shown to increase fruit size markedly (1, 2). In the present investigation, apparently the stimulation in fruit growth as a result of 2,4,5-T application was about equal to the stimulative effect resulting from the early dropping of 69.5 percent of the fruit from the unsprayed trees.

The application of 2,4,5-T 2 days after the occurrence of a frost, likewise, was found to be highly effective in preventing drop and promoting growth of severely damaged Tilton apricots. On the morning of April 8, a radiation frost occurred in the Davis area. The temperature, as recorded in a standard weather shelter, was 31° F for 4 hr. Since Swarbrick (5), in England, was successful in preventing drop of frosted apples by growth regulator application, it was decided to test the effectiveness of 2,4,5-T on the apricot in this respect.

On the morning of April 10, approximately 55 hr after the occurrence of the frost, half of each of three Tilton apricot trees on the university campus were sprayed with a 40-ppm aqueous solution of 2,4,5-T. Full bloom had occurred on these trees on March 9, just 30 days prior to the time of spraying. When the spray was applied, there was no evidence of pit hardening or of endosperm tissue. The exteriors of the major portion of the fruits presented a blistered appearance, while, internally, the integuments had turned brown and the nucellus was water-soaked.

By April 25, 17 days after the frost, 100 percent of the fruit on the unsprayed portions of the trees had dropped, as well as all the fruit on unsprayed neighboring trees. In marked contrast, counts on large

tagged branches revealed that only 1.5 percent of the fruit had dropped from the sprayed portions of the trees. When the fruit was harvested on July 3, a total of only 3 percent of that which was sprayed had dropped from the trees. When compared with fruit from a neighboring orchard that had been heated during the frost, the fruit from the sprayed trees was of normal size and flavor but somewhat misshapen. The skin was rough and scabby; suberization of the blistered areas had taken place. Not a single fruit was found to contain a normal embryo. In fact, in addition to the killing of the ovules at the time of frost, the endocarp tissue in most of the fruits was injured. When the fruits were examined internally at maturity, hypertrophy of large areas of the endocarp was found to have occurred.

Maturity of the sprayed fruit, both at Winters and at Davis, occurred from 7 to 10 days earlier than maturity of fruit that was not sprayed. The effects of 2,4,5-T application on maturity of apricots has been discussed in detail elsewhere (1, 2). Other than a temporary flagging of the foliage and an inhibition of shoot growth following spray application, no deleterious effects on the trees were noted. This also has been discussed elsewhere (1, 2).

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## Communications

### Air-Borne *Histoplasma capsulatum* Spores

IN A study by Grayston and Fureolow (1) the epidemiologic features of 13 epidemics of histoplasmosis were presented and the conclusion was drawn that "the clinical features of the illnesses lead to the conclusion that infection occurred through the inhalation of air-borne organisms." Ibach, Larsh, and Fureolow (2) reported the isolation of *Histoplasma capsulatum* spores from the air in chicken houses located on farms where known cases of histoplasmosis had occurred. However, no one up to the present time appears to have reported the incidence of air-borne *Histoplasma capsulatum* spores in the open air.

During the pollen and spore season of 1952, a "continuous recording particle" sampler, described by Stenborg and Hall (3), was kept in continuous operation from early spring until late fall. With this volumetric sampler, air-borne particles are impinged upon a moving strip of adhesive tape. Upon re-examination of this permanent seasonal record for air-borne fungus spores, *Histoplasma capsulatum* spores were encountered (Fig. 1). Although we have just started this second study and have only scanned our records for Aug. 26-31, nineteen such spores have been identified. The maximum rate of spore deposition thus far was 6/hr. As each hour's reading represents approximately 1 cu yd of sampled air this would mean, if this dosage was maintained over a 24-hr period, an inhalation rate of *Histoplasma capsulatum* spores for the adult at rest, or approximately 100 during normal activity.

Although six *Histoplasma capsulatum* spores is the maximum number found for any one hour of sampling up to the present time, this dosage actually represents the minimum exposure of individuals living in this area, in that our sampler was placed on the top-most ledge (75 ft above the ground) of a tower on the Medical Laboratory Building in Iowa City.

All typical tuberculate chlamydospores were sub-

mitted for further examination to those engaged in research on histoplasmosis.<sup>1</sup> Although their study is being conducted on the same floor of the building where our records have been stored, contamination of

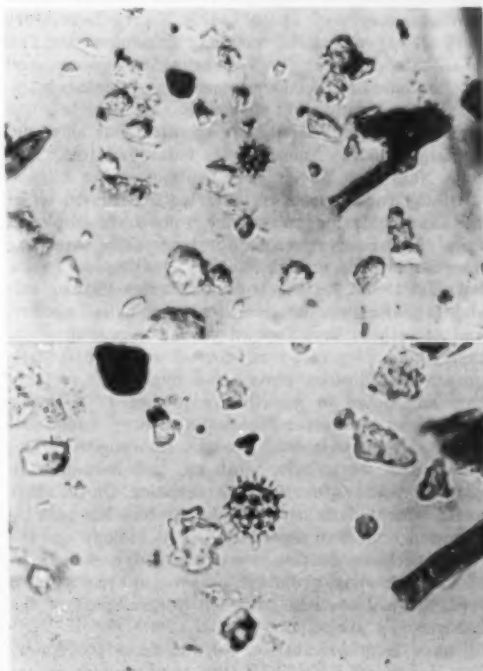


FIG. 1. *Histoplasma capsulatum*, typical air-borne tuberculate chlamydospores. Above, X = 450; below, X = 810. [Original magnifications, 750 and 1350.]

<sup>1</sup> I. H. Borts, director, and Gordon E. Nielson, senior bacteriologist, State Hygienic Laboratory, Iowa City.

these records from within the building is impossible in that the pollen and spores collected are automatically sealed between two layers of tape at the time of sampling.

Intraperitoneal injections into mice of spores collected with another sampler during the season of 1953 are now under way, as well as a further examination of our 1952 seasonal record.

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### Cancer Research at a Marine Laboratory

So that workers in the field of cancer biology may be encouraged specifically to explore the almost limitless possibilities of marine organisms as tools for experimental oncology, an arrangement has recently been completed with the American Cancer Society whereby qualified investigators with cancer-oriented problems may work at the Lerner Marine Laboratory with all expenses paid, including transportation, full board and room at the Laboratory's residence, and the purchase of special equipment. Investigators interested in such support of their work should write to the undersigned: Chairman, Department of Fishes and Aquatic Biology, American Museum of Natural History, New York 24.

Of the various cancer studies so far carried on at the Lerner Marine Laboratory, some have employed eggs of marine organisms for large scale screening of presumptive growth-inhibiting substances, some have dealt with the effects of toxic extracts from marine organisms on the growth of mammalian tumors, and yet others have focused on the comparative cytology and physiology of normal and hyperplastic growths. Studies on purine and pyrimidine metabolism as related to growth are projected. Materials available at the Lerner Marine Laboratory would well be suited to experimental work on embryogenesis and the role of organizers, vitamins, and hormones in growth, proliferation, and differentiation. On the other hand, work undertaken at the Laboratory has been by no means limited to aspects of growth biology and the cancer problem. Studies in marine ecology, animal behavior, taxonomy, evolution, oceanography, etc., have been and will continue to be an integral part of the Laboratory's program.

Funds from private sources and from the American Museum of Natural History, together with grants from the Damon Runyon Fund, the American Cancer Society, and the U. S. Public Health Service, have contributed to the work carried on at the young Lerner Marine Laboratory. Here, at the eastern edge of the Gulf Stream, the Lerner Marine Laboratory stands far

from the bustle of campus or metropolis, and yet only thirty minutes by air from the facilities of Greater Miami, Florida. The isolation so often longed for by scientists trying to do serious work at a student-crowded summer station, is on the Island of Bimini a reality. A steady semitropical climate permits operation of the Laboratory throughout most of the year; projects of nearly any duration may be undertaken. A profusion of experimentally suitable marine fauna and flora is available for easy collecting within a literal stone's throw of the Laboratory door. The Laboratory maintains fully equipped research rooms for ten senior investigators and their assistants, along with rooms or setup space for special studies in physiology, histology, pathology, biochemistry, aquatic biology, etc. Adjoining the main laboratory building is a spacious and comfortable residence where living quarters and meals are provided. Bimini, as one of the Bahama Islands, is under British administration, but no visa or passport is required of visiting American scientists.

The Lerner Marine Laboratory is a field station of the American Museum of Natural History. Although originally restricted to members of the Museum's research staff, its facilities are now offered to qualified investigators from anywhere in the world.

C. M. BREDER, JR.

*Lerner Marine Laboratory*

*The American Museum of Natural History  
New York City*

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### The Hayward Fault of California at Its Type Locality

MAJOR earthquakes in 1836 and 1868, and many minor quakes since, convincingly show an active fault zone near the front of the northwest-trending hills that rise abruptly on the east side of San Francisco Bay. A fault in this zone has been traced for more than 60 mi, between San Pablo Bay and San Jose, and it may be much longer. It has been named for the town of Hayward, which sits astride it, about 15 mi southeast of Oakland. Although long recognized and frequently mentioned in geologic literature, the Hayward fault has been little studied in the field. As part of a larger project, about 9 mi of the fault zone near Hayward has recently been mapped in detail.

Near Hayward, evidence of active faulting is confined to a narrow zone where the hill front meets the San Francisco Bay plain. For 4 mi northwest of Hayward the zone is bounded by two rather well-defined fault traces, 1000 to 2000 ft apart, that isolate a row of undissected bedrock ridges—apparently “shutter ridges.” For 4 mi southeast of Hayward only one active fault line was traced. It does not follow the hill front, which here is somewhat irregular but forms an inconspicuous, slightly sinuous, topographic sag a few hundred feet to 2000 ft back of the hill front. Parts of this long swale are undrained. Another roughly parallel fault line probably exists on the Bay plain

about 2000 ft to the west, but it was not accurately located. For 2000 ft, in urban Hayward, the fault zone is in an alluviated plain that breaks through the hills; individual faults have not been traced across this plain.

Most stream courses are sharply offset to the north wherever they cross the fault zone. San Lorenzo Creek, a main west-flowing stream, cuts through the hills at Hayward, turns sharply northwestward, and follows the fault for more than a mile before resuming its westerly course. Offsets of other, lesser stream courses do not exceed a few hundred feet and, for most streams, are less than 50 ft.

There is stratigraphic, as well as geomorphic, evidence of horizontal movements. Southeast of Hayward, rocks of Upper Jurassic and early Pleistocene ages on the west side of the fault have apparently been shifted about 1200 ft northwestward. Nearly 4 mi of relative northward horizontal displacement of the west side of the fault may be inferred from the position of outcrops of the Knoxville formation of Upper Jurassic age; however, other interpretations are possible. Recurrent horizontal displacements clearly began in late Pleistocene time or earlier and have continued to the present.

The abrupt and rather straight, although dissected, hill front suggests vertical displacements on an essentially vertical fault plane. As shown by wells drilled on the Bay plain within a few hundred feet of the hill base, the steep bedrock front continues far below the Bay plain. In places, 650 ft or more of unconsolidated marine and alluvial deposits are banked against it. Total vertical displacement may have been far more than 1000 ft. Most of the vertical displacement happened so long ago that the original scarp has retreated and streams have cut away the rapids or waterfalls, which must once have existed at fault crossings. Thus, displacements of the last hundreds or thousands of years seem to have been largely horizontal.

The narrow Hayward fault zone is near the western edge of a broad faulted belt extending more than a mile back into the hills. In the hills are two long faults subparallel to the hill front, linked to each other and to the Hayward fault by short east-west transverse faults. The two long faults seem to be high-angle reverse faults with largely dip-slip displacements, the southwest sides having moved relatively up and north-eastward. These faults, despite probable displacement of many hundreds of feet, are largely without topographic expression and seem to have been inactive for thousands of years.

Viewed broadly, the entire fault belt is well regarded as a single great fault zone. It is understandable that the term "Hayward fault" has gradually come to be applied to the entire mile-wide belt. This application has led to the widespread notion that the entire belt is equally active seismically and offers equal earthquake risk. But only a narrow strip near the hill front is clearly an active fault zone in which earth movements may reasonably be anticipated; most of the faulted belt in the hills offers much less short-term

engineering risk. Particularly for this reason, it seems desirable to follow the original usage of the term "Hayward fault," and to apply it only to the narrow zone of definitely active faulting.

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## **Kaolin of Early Eocene Age in North Dakota**

LIGHT-COLORED kaolinitic clays that comprise the lower part of the Golden Valley formation cap many of the divides and underlie several small synclines in southwestern North Dakota. The stratigraphic relationships and flora of the Golden Valley formation as a whole indicate an early to middle Eocene age, and the lower kaolinitic portion is almost certainly earliest Eocene, the time equivalent of at least a part of the Wasatch formation.

The kaolin must have once blanketed most of southwestern North Dakota and may have an even wider extent. A line circumscribing the outermost outcrops encloses an area of more than 6000 mi<sup>2</sup>, and none of these outcrops suggests an approach to the original depositional limit of the clays.

Over their large outcrop area, the clays of the Golden Valley formation are remarkably uniform. Most exposures are 15 to 25 ft thick with the extreme range 5 to 45 ft. In gross aspect, most outcrops consist of three major units: (1) A basal unit of light purplish gray shaly clay, slightly carbonaceous and locally with numerous fossil plants; this clay is typically silty, but a few local lenses are plastic and silt-free. (2) A middle unit (missing in a few localities) of tough white sandy fire clay, mottled and stained yellow orange by iron oxides; the oxides seem to come from small limonite pellets that are the weathered relics of siderite pellets. (3) An upper unit of purplish gray clay similar to the basal unit; a thin impure lignite or dark carbonaceous clay commonly overlies the upper purplish gray clay and forms the top of the outcrops.

Locally the lower part of the formation grades laterally into a white crossbedded sand with a kaolin binder. The sand consists chiefly of angular to sub-angular quartz, as much as 20 percent angular calcite, 2 to 5 percent feldspar, muscovite, and about 3 percent heavy minerals, including garnet, tourmaline, kyanite, and others. The calcite is in discrete particles and does not appear to be a cement. Its origin is unknown. None of the minerals including the feldspars show signs of weathering since deposition.

Laboratory tests indicate that the clay beds consist chiefly of kaolinite (with minor amounts of halloysite or endellite), quartz, detrital mica, and some amorphous silica. The kaolinite is a fine-grained aggregate and shows no wormlike crystals or "books." Minor constituents consist of siderite pellets in the white fire clays, secondary iron oxides, and tiny veinlets of iron-

montmorillonite (?). The montmorillonite is secondary and appears to be associated with the iron oxides.

With the possible exception of the calcite, all the major constituents are of sedimentary origin and have undergone little or no change since deposition. The kaolin was transported as kaolin and laid down in a continuous blanket over many thousand square miles. This suggests deposition in a large shallow freshwater lake, an idea supported by the nature of the flora and the presence of lignite lenses in the clay beds. The shallowness enabled streams to build natural levees and carry sand for some distance into the lake.

Such a large blanket of relatively pure kaolin must indicate a source area (to the west) that was subject to deep intensive weathering but little erosion at the close of the Paleocene epoch. This is about the time of formation of the bauxite and kaolin deposits of the Gulf Coastal Plain, and possibly also of the kaolin deposits in the Pacific coastal states. The end of the Paleocene epoch seems to have been a time of intense and rapid weathering over much of the country.

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### *Spirodiscus* Ehrenberg Identified as *Ophiocytium* Nägeli

EHRENBURG's work, the *Infusionsthierchen* (1), is an important landmark in the history of protozoology and a minor one in the history of bacteriology. In this work, Ehrenberg set up a family Vibrionia, with five genera, *Vibrio*, *Bacterium*, *Spirillum*, *Spirochaeta*, and *Spirodiscus*. Among these genera, the first four include most of the bacteria as known at the time. *Spirodiscus*, on the other hand, is clearly not a bacterium. It appears to have remained unidentified until the present.

A single species, *Spirodiscus fulvus*, was listed. It had been named without description in an earlier publication (2). In the original description (1) the main points were as follows:

Dreissigste Gattung: Scheibenspirale. Spirodiseus. Spirodisque.

Character: Animalia e familia Vibrioniorum, divisione spontanea imperfecta (et obliqua ?) in catenam filiformem a cochleam rigidam disciformem accrescens. . . .

99. Spirodiseus fulvus, gelbbraune Scheibenspirale. Tafel V. Fig. xiv.

Sp. cochlea lenticulari, obsolete articulata, fulva, 100-mam lineae partem fere lata. . . .

The organism had been found at Syrjanofskoi, in the Altai Mountains, in fresh water among confervas.

Some of the points of this description, as "imperfect spontaneous division," appear to be without objective meaning. The figure to which the description refers consists of four little drawings whose appearance and size may be understood by the statement that they look like pods of bur clover, *Medicago*, and are colored with brown and green stripes. The characters

to which anything identified as *Spirodiscus* must conform are these: it is a freshwater organism with cylindrical pigmented cells more or less compactly coiled and having an overall diameter of about 20  $\mu$ , that is, 1/100 of a line.

Here it is pointed out that the organism known as *Ophiocytium parvulum* (Perty) Braun conforms to the characters stated. No other organism is known to do so. It is accordingly maintained that *Spirodiscus fulvus* is *Ophiocytium parvulum*.

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- Received December 8, 1953.

### Basaltic Magma at Hawaii Is Saturated in Silica

MODERN knowledge of the geology of Hawaiian volcanoes has established that most of the lava of all the separate volcanoes has been erupted in a stage of primitive shield-building activity. A small volume has been added to many of the volcanoes in a declining phase of the primitive shield-building stage, and a very small amount has been erupted at a few volcanoes in a stage of decadent activity. The petrography of the rocks of the primitive shields is monotonously similar through all exposed depths within a given volcano and among all the different volcanoes. The rock types present are picritic basalt, olivine basalt, and basalt, with olivine-hypersthene basalt important in a few volcanoes.

The differences in mineralogy of the shield-forming rocks are entirely in the amount of olivine and hypersthene present and, apparently, can have been caused by the concentration or removal of phenocrysts of olivine and hypersthene. Rocks formed in the declining phase of the shield-building activity commonly contain phenocrysts of augite and calcic plagioclase but, otherwise, are similar to those making the bulk of the shield.

A most important difference does not appear in the gross mineralogy and, commonly, is not even apparent in microscopical mineralogy. This is the fact that the abundant olivine basalt of the primitive shield is chemically a silica-saturated rock, whereas the apparently similar olivine basalt erupted during the declining phase is chemically undersaturated in silica. Deficiency of silica is indicated by normative olivine and sometimes nepheline in the rocks of the Hawaiian province. The significant abundance or scarcity of silica can be compared straightforwardly if the percentage of normative olivine and nepheline is not used, but rather a figure is computed from the chemical analysis that states the percentage of silica needed to form saturated normative minerals. The computed abundance or scarcity of silica has been compared with

TABLE 1. Percentage of  $\text{SiO}_2$  present in amount greater or less than that required to form saturated normative minerals.

MgO in the analyses (percent)	Primitive shield rocks		Declining or decadent stage rocks	
	No. of analyses	Range of $\text{SiO}_2$	No. of analyses	Range of $\text{SiO}_2$
12-14	3	-2.7 to -1.7	3	-15.4 to -10.1
10-12	1	1.0	2	-14.6 to -8.8
8-10	5	-1.4 to 1.3	2	-10.0 to -4.6
7-8	25	0.4 to 10.0	1	-14.2
6-7	7	1.6 to 4.7	3	-6.8 to -3.7
5-6	1	5.1	3	-4.3 to -0.6

the magnesia content (as the magnesia-rich minerals are the greatest variants) from 56 analyses of rocks whose field relationships are known, 42 of the primitive stage, and 14 of the declining and decadent stage (Table 1).

Where lavas of the declining and decadent stage of activity are present, they make up the surface of the volcanoes; hence, they have been more abundantly represented in collections of rocks from which analyses have been made. Consequently, among the published analyses of Hawaiian lavas, the olivine basalts of the declining and decadent stage are represented far out of proportion to their abundance in the total volume of Hawaiian lavas. Upon averages of these analyses has been based the prevalent concept that the Hawaiian basaltic magma is undersaturated in silica. This concept is apparently not soundly based. In fact, the use of "olivine basalt" as the name of the principal magma type is open to question, since the olivine present in most of the magma was not chemically in equilibrium and is an unstable relic mineral preserved in the rocks because quenching stopped the process of resorption before it was completed.

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## The Helicopter and the Walkie-Talkie in Field Surveys

THE helicopter and the portable radiotelephone have become familiar working partners in triangulation surveys for mapping projects in mountainous areas of Alaska and the western states. The helicopter provides quick transportation for the triangulators, and the radio makes it possible to coordinate the activities of the large field crews employed.

A typical project, extending over 3000 mi<sup>2</sup> or more of desert mountains, can be triangulated in one season by seven or eight engineers with helicopters and radios. The helicopters operate a shuttle service from a base camp or from roads, thus landing the men with their instruments on mountain peaks and moving them from

peak to peak as required. Each triangulation observing party carries a portable radiotelephone (walkie-talkie), and the operation as a whole is directed from a master transmitter mounted at the base camp or in a jeep. The men can talk to one another and to the helicopters over line-of-sight distances through the base radio. If necessary, a group conference can be held with each participant on a separate mountain peak.

Both horizontal positions and elevations are determined by triangulation, using optical-reading theodolites. This kind of surveying frequently requires measuring vertical angles reciprocally and simultaneously between two stations to avoid errors from atmospheric refraction. To carry out this operation, the triangulators use a "skirt" of fluorescent cloth around the instrument tripod as a signal. Radio contacts between observers make it possible for them to relocate stations quickly when the line-of-sight is blocked by trees or visibility is otherwise impaired. By these techniques, elevations have been extended as far as 50 mi across rugged mountainous terrain with an accuracy of about 2 ft.

Helicopters are usually operated in pairs, so that a means of rescue will be close at hand in case of accident, and as insurance against prolonged delays from mechanical failure. Although engineers working with helicopters save the time required for the arduous mountain climbing ordinarily involved in triangulation, helicopters are not as maneuverable at higher altitudes as they are near sea level, and landing on high peaks where cross winds are always blowing is a critical job, even for a skilled pilot. Taking off calls for still greater skill. Pilots prefer a peak with a sheer drop-off where they can dive immediately after taking off to gain flying speed. There have been no serious accidents in 5 yr of operation in topographic surveys, but it is still far from a routine means of transportation.

The value of helicopters and radiotelephone has been effectively demonstrated during 5 yr of use on surveys in Alaska, and the Geological Survey expects that their use will do a great deal to accelerate the mapping of large areas in Alaska and in the western United States.

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## Sex Ratio and Fruit Setting in Mango (*Mangifera indica* L.)

SOME varieties of mango set fruit poorly although flowering profusely, whereas others with fewer flowers bear a good crop. To examine the probable cause of this phenomenon, observations were recorded on sex ratio and fruit set in the following varieties of mango: Romani (poor crop); Dashehari (good crop); and Langra (heavy crop).

The data in Table 1 show the number of hermaphro-

TABLE 1. Total number of flowers, flowers and percentage of total flowers resulting in fruit set at different stages per panicle. The figures indicate mean of 25 panicles.\*

Variety	Av. no. of total flowers	No. of flowers	% of flowers which set fruit at				Sex ratio of staminate to hermaphrodite flowers
			Mustard stage	Pea stage	Marble stage	Fully developed stage	
Romani	537.0	4.0	0.22	0.08	0.01	0.005	133.4: 1
Dashehari	1212.0	359.0	2.93	.84	.09	.03	2.4: 1
Langra	1061.0	732.0	4.71	.84	.08	.03	0.45: 1

\* Diameters: mustard stage, 2-6 mm; pea stage, 7-11 mm; marble stage, 12-16 mm; fully developed fruit, 30 mm and above.

dite flowers and percentages of fruit set at various stages of development. The sex ratio has also been worked out.

Since mango produces only staminate and hermaphrodite flowers, the latter play a vital role in determining the extent of yields. The varieties under observation showed a remarkable variation in percentage of hermaphrodite flowers: 0.74 in Romani (poor crop); 29.62 in Dashehari; and 68.9 in Langra. Peculiarly enough, some panicles in Romani variety consisted only of staminate flowers. The ratio of the number of staminate flowers produced in comparison with the number of hermaphrodite flowers follows a trend similar to the one shown by the percentage of hermaphrodite flowers.

It is clear from Table 1 that the variety having a lower percentage of flowers and large sex ratio had very low fruit set, whereas those having high percentage of flowers and small sex ratio gave heavy fruit set. The fruit set was so much affected by the num-

ber of hermaphrodite flowers and the sex ratio that, out of 1263 panicles produced on a Romani tree, only 32 fruits developed to maturity, whereas in Dashehari and Langra, 1015 and 2600 panicles produced as many as 350 and 700 fruits, respectively.

Thus the present observations taken under the same set of conditions indicate that poor setting in variety Romani is due to the large sex ratio and low percentage of flowers in a panicle. It may be possible to declare the most suitable sex ratio for optimum yield, after further investigations.

Further work is in progress and the detailed results will be published in due course.

The author is thankful to Dr. I. B. Singh for suggesting the problem and his keen interest throughout the progress of this work.

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## Extensions in Geographic Range or Lack of Data?

RECORDS of the extension of the geographic range of animals and plants into areas where it had been assumed that conditions would not permit them to exist, at least in appreciable numbers, are not new. There are many authenticated records of such movements. It is not the purpose of this communication to cast doubt upon any of the cases where ample supporting data exist, but rather to suggest that many examples of species adapting themselves to new conditions may be the result of insufficient information. This has been well illustrated in a recent communication by Kaston [*Science* 119, 192 (1954)] in the case of the black widow spider, *Latrodectus mactans* (Fabricius) in the New England area. My experience in Maryland with the same species appears to support Dr. Kaston.

From 1925 until 1932, I had never collected a black widow spider in the state, although I had seen the living animal farther south. In the early 1930's, a rash of newspaper and magazine articles created great interest in this supposedly deadly creature, and in-

quiries began to be received at the University of Maryland. The spider was presumed by many to be rare, but several popular writers suggested that it was moving in on the area around Washington, D.C.

With five students of entomology I began an expedition one afternoon in October in search of the black widow. Less than 200 yd from our starting point and while still on the campus, we discovered eight females and five males, in less than 10 min. As soon as we learned exactly where to look, we found the spider surprisingly abundant, and from that year on we always had live specimens in the laboratory during spring and autumn.

An entomologist who had worked in Maryland much longer than I confessed that he had never taken a living specimen, although he had received a few in the mail. After walking a short distance from the building that contains the entomological laboratories, we easily found several specimens, and from that time on he experienced no difficulty in making further collections.

Dr. H. E. Ewing, who worked with Arachnida in the Washington area for many years, told me that he had collected the black widow only a few times, although he had not made any special effort to do so.

It was his opinion, long before editors discovered that this animal was good copy material, that the species was inconspicuous but relatively common.

I also discovered that several species of Hemiptera supposedly rare or absent in the Maryland fauna were quite common. Several presumably northern forms were found, not in the western part of the state where their presence would have been no surprise, but in a region that has a growing season of more than 200 days, at sea level. They were feeding on a host that is common only in the warmest parts of the state, and apparently no entomologist had ever taken the trouble to examine this plant during the autumn. It seems obvious that climate was not the factor that limited the distribution.

Without discounting the possibility of ecologic changes, increases in cold-hardiness, and similar factors, we ought to examine all reports of extensions into new territory with skepticism, unless they are supported by more than casual observation.

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## Mechanism of Suppression of Hemagglutinating Viruses

WE WISH to make confirmatory elaboration on the explanation of Groupe, Pugh, and Levine (1) for Newcastle disease virus inhibition by their achromobacter fermentation product (A.P.M.). They adduced evidence that A.P.M. probably acted by competition with a virus for receptors on the target cell rather than as a direct "virucidal" agent. On the other hand, McCrea and Duran-Reynals (2), in their report on vaccinia inhibition by hyaluronate-depolymer dialysate or glucuronolactone, imply virustatic or virucidal activity.

Preliminary clarification of the mode by which certain hemagglutinating-virus antagonists operate, pending appearance of a definitive report, may assist other investigators, because a hypothesis with seemingly broad implications has developed. Properties similar to those reported for A.P.M. had been encountered in the antibiotic-free and cobalamin-free carbohydrate fraction of the streptomycin fermentation residue made available as poultry feed (APF). Besides inhibiting vaccinia, Newcastle, and influenza virus hemagglutination, this fraction exhibited slight antihyaluronidase and antithrombic activity. The fraction was pigmented, so coprogen was tested and proved negative. However, lithium ferriprotoporphyrinate, a known antithrombic (3), as well as other vinyl porphyrins elicited decided inhibition of human erythrocyte hemagglutination (as evidenced in titrations with

type specific and "rhesus type" antibodies, the latter in both direct and "blocking antibody" phases), including that by influenza B, Newcastle, and vaccinia. Infectivity inhibition of the latter was also demonstrated, using NDV strain CVB-14 in the allantoic sac of eggs and lymph vaccinia (Lederle) in rabbit abdominal skin as described by McCrea and Duran-Reynals. As a matter of fact, ordinary "water-soluble chlorophyll" (which is a chemically defined genus of alkali cupri-monovinylidihydroporphyrinates) is a practically utilizable competitive inhibitor of the hemagglutinating viruses, duplicating the effect of A.P.M., or the depolymer dialysate of McCrea and Duran-Reynals, in 0.02-millimolar solution. Its inhibitory effect has been found to be competitive, as Groupe, Pugh, and Levine postulated for their "antivirals."

Further study with "chlorophyllin" allocated its competitive activity to the enhanced resonance conferred on the pyrroles by a chelated transition element metal. The carbocyclic ring of "dibasic chlorophyll" is noncontributory; "tribasic chlorophyllin" (in which this ring has been opened) is even more active (5). From consideration around isosterism of pyrrol and a potentially resonating furanoid structure for glucuronolactone, it had been postulated that low-molecular weight solutes having an "aromatic" heteropentacyclic ring might effect that resonance contribution which would be isosteric with the modality for virus (presumably the furanoid, ribose) attachment to the cell receptor and compete for the latter with the virus. The hypothesis became theory when Tamm, *et al.* (4) demonstrated influenza B inhibition by benzimidazoles, which have the postulated configuration. This inhibition, from their data, is evidently competitive.

It is fair to assume that, had thiazoles, pyrazolines, and thiophens been tested under conditions which would have revealed competitive inhibition instead of having been tested for virucidal effect, the evanescent interest that they aroused as antivirals might have persisted. Their reexamination in this light seems warranted.

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## Book Reviews

**Embryology.** Rev. ed. Lester George Barth. New York: Dryden Press, 1953. 516 pp. Illus. \$6.00.

The preparation of a textbook which for the first time attempts to combine descriptive and experimental studies must, as the author himself has commented, be regarded as an experiment; and, like most "first" experiments, it is to be expected that revisions and refinements will be needed as time goes on. The present, second, edition represents these revisions and refinements to the extent of nearly doubling the original number of pages.

The great increase in the number of pages is due primarily to the addition of figures and figure legends. Ninety-seven of these constitute a new chapter, the 21st and last, dealing with the comparative embryology of vertebrates. This can actually be used in the laboratory as a manual. Well-executed and well-labelled drawings of typical cross sections and dissections of embryos of the frog, chick, pig, and man, at several developmental periods, have been quite ingeniously arranged so that a specific organ can be studied either chronologically through its development in one embryo, or comparatively in several different embryos at the same time.

Throughout the text (chs. 1 to 20) approximately 75 new illustrations, mostly half-tone reproductions, taken from original papers of outstanding authorship, have been added as companion illustrations to supplement the excellent, schematic teaching diagrams typical of the first edition. These numerous photographs and drawings from the original papers are a welcome addition. They provide the student with the complete reference to much additional experimental material, thus encouraging collateral reading, and at the same time give him an accurate idea of the details and the real object under study. With such an abundance of illustrative material—photographs for realism, diagrams for easy comprehension of principles—the teaching value of this refreshingly unique book has been greatly enhanced.

The general subject outline has not been much changed. New material has been added here and there, but primarily to the sections on the nervous system and the mesodermal derivatives. A fuller account of the early development of the chick has also been given, including the origin of the layers of the blastoderm, the movement of cells in the formation of the primitive streak, and the relationship of the primitive streak to the later embryo. A slight change in organization, affecting the order of presentation of material, has been made. In the present edition the description of the development of the frog and chick precedes the analytical experimental treatment. This was done with the hope of its being of greater help to the student in his visualization and comprehension of the principles of development.

In general, the revisions and improvements which

the author has made are quite praiseworthy and undoubtedly will increase the usefulness of the text. The present edition can be highly recommended as a teaching guide for college students beginning their study of embryology.

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**Five-Membered Heterocyclic Compounds Containing Nitrogen and Sulfur or Nitrogen, Sulfur, and Oxygen (Except Thiazole).** L. L. Bambas. New York: Interscience, 1952. 403 pp. \$14.00.

This is the fourth volume to be published in a series of monographs whose purpose is to cover the large and complex classes of heterocyclic compounds in a detailed and comprehensive fashion. The contents are divided into three parts. The chemistry of the thiazoles takes up the first 211 pages. It is followed by a short chapter (8 pp.) on five-membered rings containing nitrogen, sulfur, selenium, or oxygen atoms in addition to one sulfur and one nitrogen atom. Finally, the third part presents in 148 pages the isothiazoles and their derivatives.

The contents of the various chapters are well organized and the historical development is chosen to describe uncritically the chemistry of the vast number of compounds. The presentation of many structural formulas and equations are very helpful to the reader in following the sometimes complex reactions. Tables at the end of each subdivision summarize methods of preparation of individual compounds and give their structural formulas and physical data, e.g., solubilities and melting points. The large number of references cited, cover the literature through 1950.

This reviewer feels that the short discussions and critical evaluations of the literature at the conclusion of most of the chapters are very desirable. They show the reader some of the contradictions which occur in the literature and point to the direction in which further research is needed.

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**Adrenal Cortex:** Transactions of the Fourth Conference, November 12-14, 1952, New York. Elaine P. Ralli, Ed. New York: Josiah Macy, Jr. Fdn., 1953. 165 pp. Illus. \$3.50.

This book records the transactions of the fourth of five scheduled Macy Foundation conferences on the adrenal cortex. As is usual with these conferences, attendance was limited to 25 invited members. Discussion topics comprised four broad subjects, three of which were introduced by formal presentation of conference members. Most of the volume is filled, however, with the three-day informal discussion, well-edited by Dr. Ralli.

These proceedings do not serve, and are not intended to serve, as reference works. The volume excellently, however, records the current pattern of thinking of the 25 discussants involved, a pattern which will determine the nature of much of the formal bibliography on the adrenal cortex for succeeding years.

The first topic discussed was "the Permissive Action of Adrenal Cortical Hormones. This term, generally associated with the name of Dwight Ingle, refers to those situations in which the presence of some minimal amount of cortical hormone is required before some other substance or influence can induce a characteristic response. The concept has served the admirable purpose of reducing the formidable number of things caused by the adrenal cortex, in the sense that *permissio*n can be substituted for *cause*; the distinction has eased conceptual effort whether or not it has added greatly to basic understanding. By implication, however, *permissive action* refers to all-or-none phenomena—that the so-called permissive actions of the cortical hormones are indeed all-or-none actions was called into serious question by the discussants, including Ingle himself.

The second topic was entitled Mechanisms Through Which the Adrenal Cortex Produces Qualitatively Different Effects and its discussion led by Hans Selye. The explorations of this provocative topic, much of which concerned Selye's work on the interaction of adrenal and pituitary hormones in both general and localized adaptation syndromes, filled one-third of the volume. Although the discussion was of great interest, the novice should not expect that perusal of the chapter would provide any final answer to the problems raised by the title.

The third subject, Existence, Nature, and Site of Production of a Salt Hormone (Mineralo-Corticoid) Secreted by the Adrenal Gland, was introduced by Martha Vogt of Edinburgh. This is the most exciting subject in the adrenal field at present because of evidence that the most potent adrenal hormone is yet to be identified and its full biological properties described. The hormone concerned, however, was reminiscent of the elusive rabbit in *Harvey*; its portentous reality was accepted but it never emerged into a state of visibility. Subsequent chemical work has assured that it will do so soon, since the probable chemical entity involved has been crystallized (see S. A. Simpson, et al., *Experientia* 9, 333 [1953]).

In the last chapter, Effects of Adrenalectomy in Man, F. D. W. Lukens presented a summary of experience of the Philadelphia group with 69 cases of total or partial adrenalectomies performed as an experimental therapy for hypertension. Little attention was given to the other possible indications for adrenalectomy. In general, it seemed that adrenalectomy can serve as a rehabilitating and life-saving procedure in certain types of cardiovascular disease, and particularly in those cases without pre-established renal pathology. This was an encouraging estimate of the situation in view of the fact that the only cases so

treated were those refractory to the usual medical therapies.

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## New Books

- The Collected Papers of Otto Fenichel.* First series. Hanna Fenichel and David Rapaport, Eds. New York: Norton, 1953. 408 pp. \$6.50.
- Wildlife in Alaska: An Ecological Reconnaissance.* A. Starker Leopold and F. Fraser Darling. (Sponsored by the New York Zoological Society and the Conservation Foundation.) New York: Ronald Press, 1953. 129 pp. Illus. + plates. \$2.75.
- Readings in the Philosophy of Science.* Herbert Feigl and May Brodbeck, Eds. New York: Appleton-Century-Crofts, 1953. 811 pp. \$6.00.
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## Association Affairs

### The American Dental Association: Status Changed from an Associated to an Affiliated Society, AAAS

THE American Dental Association, which was founded Aug. 3, 1859, at Niagara Falls, N.Y., by a group of 26 dentists, is today the largest professional organization of dentists in the world. At the end of Oct., 1953, the total membership included 70,029 U.S. dentists and nearly 10,000 dental students, representing approximately 80 percent of all dentists in the nation. The Association has 54 constituent (state and territorial) dental societies that carry on active programs. The Central Office of the Association is at 222 East Superior St., Chicago, where 117 of its 131 full-time employees are stationed. An office is also maintained in Washington, D.C.

Leslie M. FitzGerald, of Dubuque, Iowa, is president of the Association. Other officers are: Daniel F. Lynch, president-elect; Walter J. Pryor, Cleveland, first vice president; Charles A. Pankow, Buffalo, N.Y., second vice president; Hollis O. Warlick, Enid, Okla., third vice president; Harry Lyons, Richmond, Va., speaker of the House of Delegates; Harold Hillenbrand, Chicago, secretary; H. B. Washburn, St. Paul, Minn., treasurer; and Lon W. Morrey, Chicago, editor.

The Association carries on a nation-wide program of activities "to encourage the improvement of the health of the public and to promote the art and science of dentistry." Supported by an annual budget of nearly 2,000,000 dollars, these activities are so extensive that only a brief mention of a few can be made here. Over-all policies are established by the House of Delegates, composed of representatives of each constituent dental society. Fiscal managements are handled by a 13-member board of trustees. There are 18 permanent councils and a number of bureaus and departments which carry on specific functions.

A typical program of an A.D.A. agency in providing services for the public and for members of the dental profession is that of the Council on Dental Therapeutics. It tests and analyzes drugs and materials offered to dentists by commercial manufacturers and provides detailed reports to the profession; also it evaluates evidence for therapeutic claims of dentifrices, mouth washes, and other products sold directly to the public. Through these activities, both the dentist and the public are provided protection against inferior, worthless, or harmful products.

The Council on Dental Education, which inspects accredited dental schools, carries on an extensive program of dental aptitude testing which now is being used by every dental school in the nation. These tests are given to applicants for admission to dental schools, and the test scores have been a major factor in sharply reducing the loss of students through academic failures.

Specific instances of long-continued interest in research is illustrated by a reference to the work of

the Council on Dental Research. Two groups of Association fellows are maintained, at the National Bureau of Standards and at the National Institutes of Health. The fellowship staff at the National Bureau of Standards, established a quarter of a century ago, now totals 10 and consists of 2 dentists, a chemical engineer, a physical chemist, a metallurgist, a chemist, a crystallographer (on leave of absence at the University of Liège), and 3 technical and clerical assistants. This research program has received overwhelming acceptance here and abroad and has resulted in far-reaching changes in the selection and use of materials in dental therapy. The Association fellowship program at the National Institutes of Health was established Sept., 1941. There a biochemist is studying the relation of various protein diets to the incidence of experimental dental caries. A bacterial physiologist is investigating the effect of diets and chemical additives on the oral flora of experimental animals. The original study in oral spirochetology, conducted by a dental microbiologist, is now in its 12th year and has added much knowledge to this particular field.

The Bureau of Economic Research and Statistics carries on continuing studies and surveys related to dental practice, dental income, distribution of dentists, and similar data of considerable interest to the profession, the dental trades, and government.

Each year the Association sponsors numerous conferences dealing with specific problems. Recently there was a conference designed to set minimum standards in reporting clinical dental caries research, held Nov. 2-3. The need for quantitative expression and critical appraisal is especially important in studies concerned with testing the efficacy of nutritional agents, dentifrices, and antibiotics. In Feb., 1953, 26 scientists, both from dentistry and from associated disciplines, were assigned to one or the other of 7 committees: type of index of dental caries experience; standardization of dental examinations; methods for the control of variables; use of laboratory tests in a clinical study; conduct of the investigation; analysis of data and evaluation of the results; and principles of publication. After months of study, these groups met and outlined standards that should help future investigators in achieving a higher degree of accuracy and in the reporting of studies relatively comparable with similar studies of others.

The outstanding obligation of the American Dental Association is to disseminate to its members without delay the advancing state of knowledge pertinent to the profession and the public. This manifests itself in two ways: the year-round activities of Association agencies geared to assist dental societies in carrying on programs in their respective states and local communities; and the climax of the Association year, the annual session, usually held in the fall, when a four-day scientific session is held for all members.

AAAS Council Representative  
The American Dental Association

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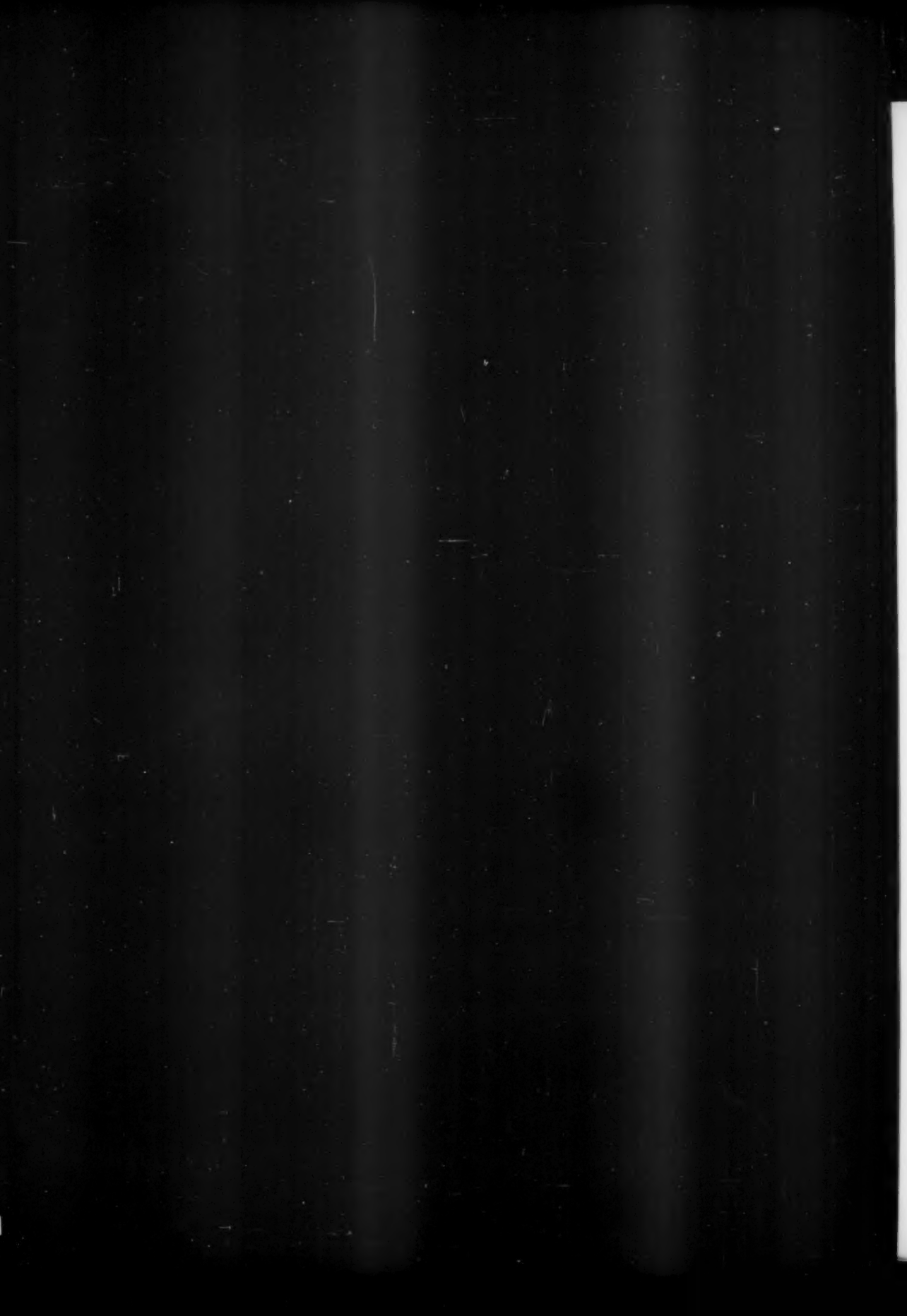
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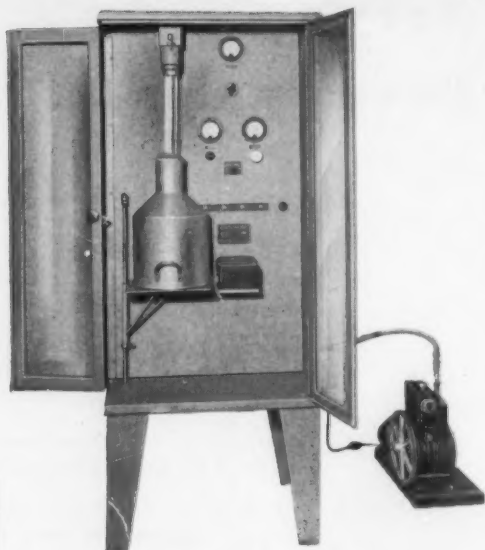
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## Shall All International Congresses Be Held Abroad?

**I**MPORTANT international conferences are still being held outside the United States because of the possibility that participants would encounter visa difficulties. At the 9th International Congress of Genetics last summer the following resolution was passed without dissent: "The Congress asks the International Committee not to recommend that the next Congress be held in any country to which it may be expected that scientists would be refused permission to enter on grounds of birth or political associations, past or present." Montreal, Canada, has been chosen for the 10th International Congress of Genetics.

On May 18, 1952, the American Psychological Association announced that the International Congress of Psychology would hold its 1954 meeting in Montreal. The statement released by the APA went on to say that "The American Psychological Association had hoped to invite . . . the International Congress of Psychology to meet in New York City. . . . Because of the delays and embarrassments which foreign scientists experience in attempting to obtain even temporary admission to this country the Association decided it could not issue the invitation." The APA went so far as to have a statement read into the *Congressional Record* [98 (88), 5920 (1952)] to the effect that, in deciding to hold the 1954 International Congress in Canada, the psychologists agreed not to have a meeting in the United States until the existing legislation is "modified in such a way that visiting scientists will not be put through an inconvenient and embarrassing procedure in order to gain permission to visit this country."

As long ago as December, 1951, the following recommendations were included in a resolution adopted by the Council of the AAAS.

The Council strongly urges that the administrative procedures under the McCarran Act be reviewed and modified

so as to minimize injustices and to increase both our internal strength and our prestige abroad.

The Council further urges revision and improvement of the relevant portions of the Act, to retain the objectives of necessary security, but with adequate provisions to maintain free interchange of knowledge that has no security implications.

On July 27, 1953, Rep. Charles S. Gubser (R, Calif.) introduced two joint resolutions, H.J. Res. 307 and 308, concerning scientists and the McCarran Act. This was the first definite action taken to alleviate the present situation. Decisions regarding the entry of scientists and scholars are now made only from the negative viewpoint of the harmful activities in which the applicants might engage. The present process of weighing evidence does not permit consideration of the advantages this country might gain by admitting a given scientist.

H.J. Res. 307 would provide for (a) a prompt decision by the consul and (b) review of unfavorable decisions by a board that would include scientists and scholars. H.J. Res. 308, the stronger of the two, makes the same provisions and in addition would allow the Secretary of State to grant nonimmigrant visas when the national interest so requires, despite some of the milder technical restrictions of the McCarran Act. Thus he would be able to resolve borderline cases in which an applicant's associations might be considered questionable, but in which there was little likelihood of the alien's engaging in subversive or illegal activity during his short visit. The potential contribution of the individual would thus be balanced against the possible harm.

The Gubser Resolutions are at present being studied by the House Judiciary Committee, which will decide whether or not they are to be presented to the House of Representatives. If these resolutions are to receive proper consideration through a hearing this spring, interested persons must write to the House Judiciary Committee indicating approval or disapproval. A congressional hearing would in itself influence the administration of visa regulations.—B. P.

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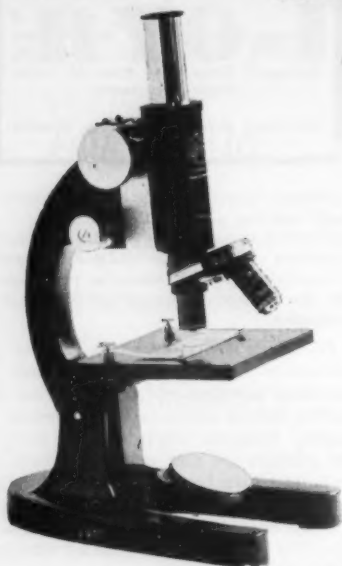
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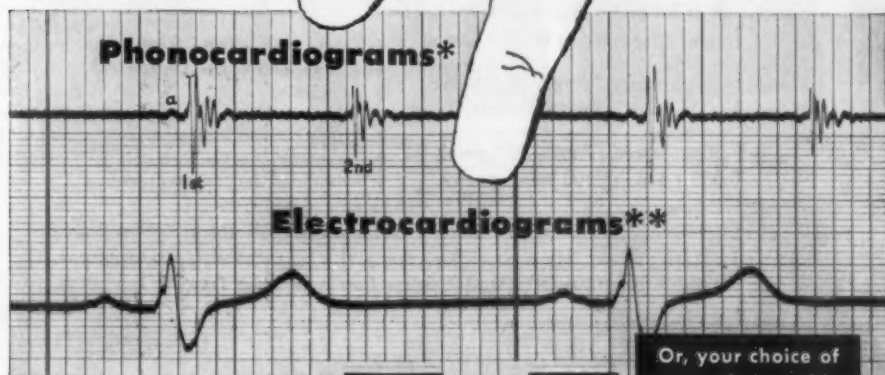
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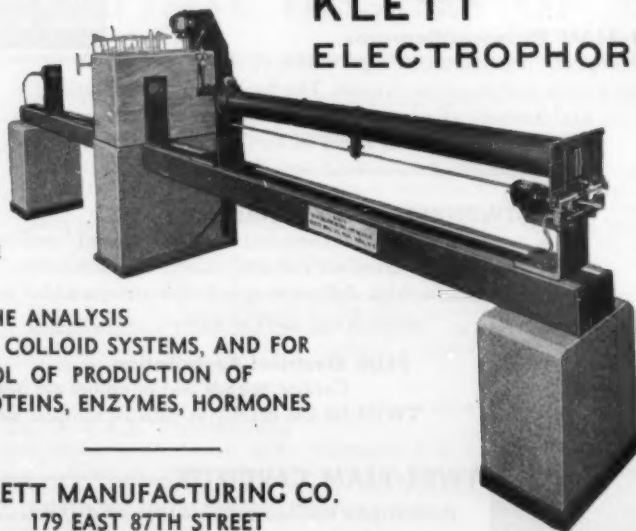
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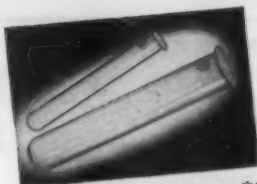
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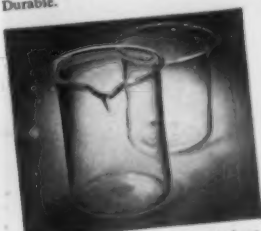
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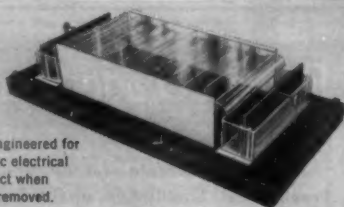
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glycyl-glycine  
glycyl-glycyl-glycine  
glycyl-DL-leucine  
glycyl-L-leucine  
glycyl-DL-phenylalanine  
glycyl-L-proline  
guanidoacetic acid (glycoeyamine)  
glycyl-DL-serine  
glycyl-L-tryptophane  
glycyl-L-tyrosine  
glycyl-DL-valine  
D-histidine HCl  
DL-histidine HCl (dihydrate)  
L-histidine HCl  
L-histidine (free base)  
histidyl-histidine  
histone (derived from calf thymus nuclei)  
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D-homocysteine thiolactone HCl  
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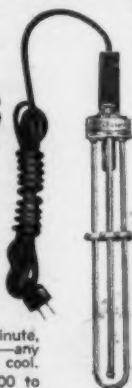
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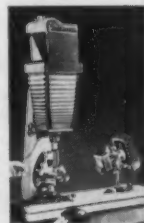
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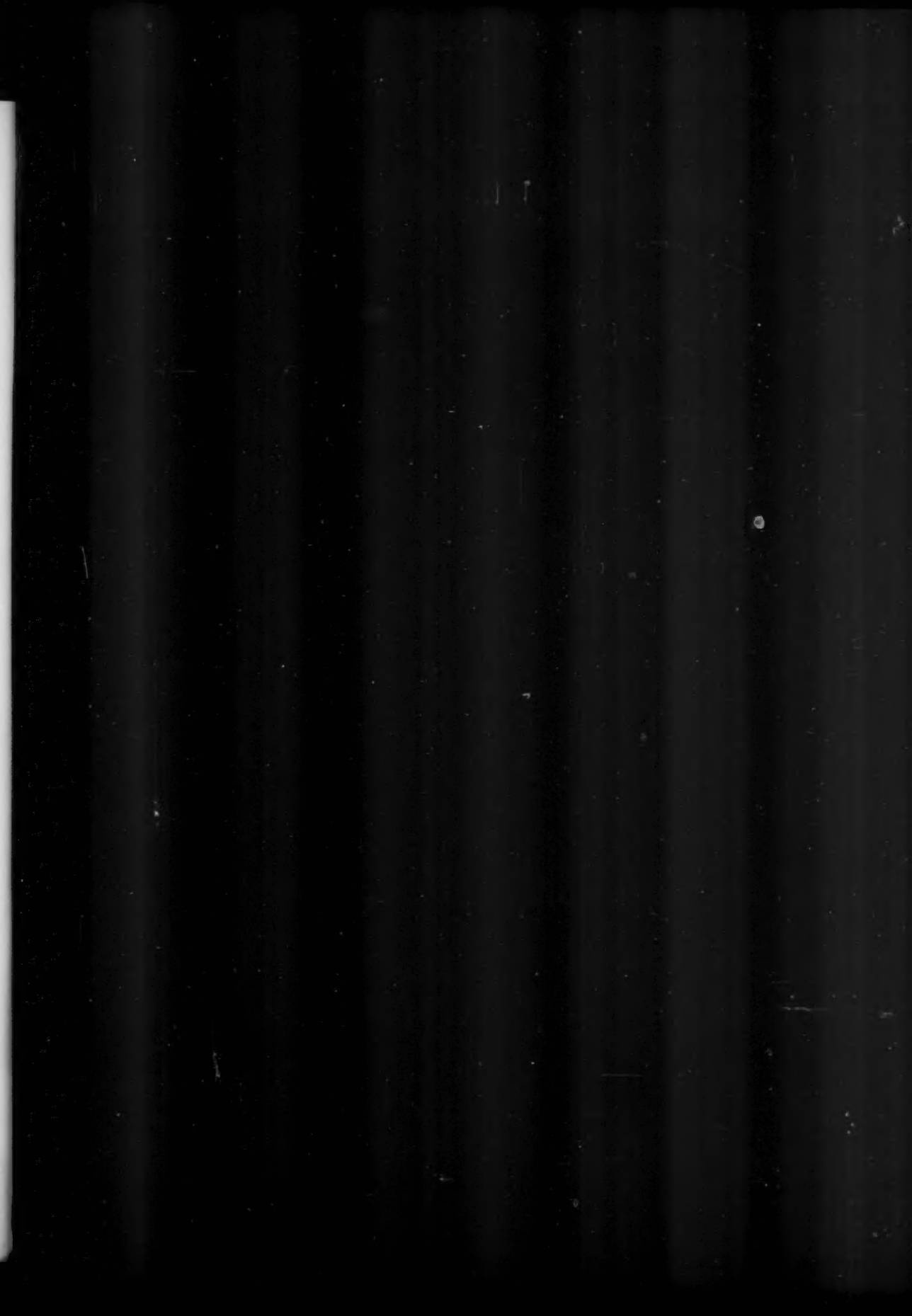
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By E. L. Attwood and H. S. Pengelly. Tenth Edition, revised by Alfred J. Sims, formerly of the Royal Naval College, Greenwich. 1953. 418 pp. 259 figs. Tables. \$8.00.

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## TEXTBOOK OF THEORETICAL BOTANY

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## MAPS AND THEIR MAKERS

By G. R. Crone, Librarian and Map Curator, Royal Geographical Society. 1953. 181 pp. 7 maps. \$1.80.

A brief introduction to the history of cartography, including classical and medieval maps, the marine chart, Catalan world maps, 15th century world maps, the revival of Ptolemy, cartography of the great discoveries, topographical surveys, Mercator and his successors, French cartography, British maps, national surveys and modern atlases.

## THE TROPICAL WORLD

By Pierre Gourou, College of France. Translated by E. D. Laborde, Harrow School. 1953. 156 pp. 16 maps. 39 plates. \$3.50.

Social and economic conditions and future status of the tropical world, covering population, health, soils, agriculture, live-stock, food supply, industrial possibilities, possible developments, and problems due to European intervention.

## MALAYA, INDONESIA, BORNEO, AND THE PHILIPPINES

By Chares Robequain, The Sorbonne. *Le Monde Malais* (Payot, Paris, 1945), revised, translated by E. D. Laborde. Ready, April 1954. About 460 pp. Figures and maps. 16 plates. About \$6.00.

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## Meetings & Conferences

### May

- 2-6. Electrochemical Soc., spring, Chicago, Ill. (H. B. Linford, Columbia Univ., New York 27.)
- 2-7. Soc. of American Bacteriologists, annual, Pittsburgh, Pa. (F. S. Cheever, P.O. Box 1912, Pittsburgh 30.)
- 3-5. American Geophysical Union, 35th annual, Washington, D.C. (J. Adkins, Office of Naval Research, Washington 25.)
- 3-6. Air Pollution Control Assoc., Chattanooga, Tenn. (H. C. Ballman, 4400 5 Ave., Pittsburgh 13, Pa.)
- 3-7. American Psychiatric Assoc., annual, St. Louis, Mo. (R. F. Gayle, Jr., Professional Bldg., Richmond 19, Va.)
- 5-7. Soc. of Motion Picture and Television Engineers, semiannual, Washington, D.C. (Sec., 342 Madison Ave., New York 17.)
- 5-8. International Conf. on Complete Gasification of Coal, Liège, Belgium. (J. Venter, 7 Blvd., Frère-Orban, Liège.)
4. World Health Assembly, 7th, Geneva, Switzerland. (WHO, Palais des Nations, Geneva.)
- 4-6. Electronic Components Symposium, Washington, D.C. (F. B. Haynes, Glenn L. Martin Co., Baltimore 3, Md.)
- 5-7. Forest Products Research Soc., annual, Grand Rapids, Mich. (F. J. Rosek, Box 2010, University Station, Madison 5, Wis.)
- 5-8. National Conf. on Health in Colleges, 4th, New York, N.Y. (Sec., American College Health Assoc., 1790 Broadway, New York 19.)
- 6-8. American Philosophical Assoc., Urbana, Ill. (M. C. Nahm, Bryn Mawr College, Bryn Mawr, Pa.)
- 8-9. Population Assoc. of America, annual, Charlottesville, Va. (H. Carter, National Office of Vital Statistics, Dept. of Health, Education, and Welfare, Washington 25 D.C.)
- 8-16. International Cong. of Thalassotherapy, Dubrovnik, Yugoslavia. (C. Plavsic, Zeleni Venac 1, Belgrade, Yugoslavia.)
- 9-14. National Conf. of Social Work, 81st annual, Atlantic City, N.J. (Office, 22 W. Gay St., Columbus 15, Ohio.)
- 10-12. IRE National Conf. on Airborne Electronics, Dayton, Ohio. (H. Pratt, 800 Quaint Acres Dr., Silver Spring, Md.)
- 10-12. Symposium on Fluorides, Cincinnati, Ohio. (Sec., Inst. of Industrial Health, Eden and Bethesda Aves., Cincinnati 19.)
- 12-22. International Conf. on Large Electric Systems, CIGRE, Paris, France. (F. Attwood, 50 Church St., New York 7.)
- 13-15. National Science Fair, 5th, Lafayette, Ind. (Science Clubs of America, 1719 N St., NW, Washington 6, D.C.)
- 14-16. American Acad. of Dental Medicine, 8th annual, Philadelphia, Pa. (W. M. Greenhut, 124 E. 84 St., New York 28.)
- 14-22. Chemical Engineering and Equipment Exhibition, Frankfurt, Germany. (Dr. Bretschneider, Rheingau-Allee 25, Frankfurt.)
- 14-7. Cong. on Scientific and Technical Progress, 1st, Strasbourg, France. (L. Chereau, 28 Rue Serpente, Paris 6, France.)
- 16-19. American Inst. of Chemical Engineers, Springfield, Mass. (F. J. Antwerpen, 120 E. 41 St., New York 17.)

## Meetings & Conferences

### May, *contd.*

- 16-23. International Inst. of Welding, annual, closed, Florence, Italy. (J. S. Magrath, 33 W. 39 St., New York 18.)
- 17-20. Electronic Parts Show, Chicago, Ill. (K. C. Prince, 1 N. La Salle St., Chicago 2.)
- 17-22. International Dairy Federation, annual, Paris, France. (General Sec., 154 Rue Belliard, Brussels, Belgium.)
- 17-24. International Office of Epizootics, 22nd, Paris, France. (Sec., 12 Rue de Prony, Paris 17.)
- 18-21. American Planning and Civic Assoc., annual, Columbus, Ohio. (Miss Harlean James, 901 Union Trust Bldg., Washington 5, D.C.)
- 19-22. International Cong. of Athletic Medicine, Belgrade, Yugoslavia. (Dr. Smolaka, Deligradska 27, Belgrade.)
- 21-22. International Soc. of Surgery, Paris, France. (L. Dejardin, 141 Rue Belliard, Brussels, Belgium.)
- 21-22. Operations Research Soc., 2nd annual, Chicago, Ill. (T. E. Caywood, 203 N. Wabash Ave., Chicago 1.)
- 24-26. National Telemetering Conf., Chicago, Ill. (W. J. Mayo-Wells, Applied Physics Laboratory, Silver Spring, Md.)
- 24-27. Symposium on Instrumentation for Industrial Hygiene, Ann Arbor, Mich. (Director, Continued Education, School of Public Health, Univ. of Michigan, Ann Arbor.)
- 24-28. American Assoc. of Cereal Chemists, annual, Denver, Colo. (C. L. Brooke, Merck & Co., Rahway, N.J.)
- 29-5. International Ornithological Cong., 11th, Basel, Switzerland. (Jardin Zoologique, Basel.)
- 29-6. International Medico-Surgical Reunion, 2nd, Turin, Italy. (A. M. Dogliotti, Palazzo delle Esposizioni al Valentino, Turin.)
- 30-2. International Anatomical Nomenclature Committee, London, Eng. (T. B. Johnston, Guy's Hospital, London, SE 1.)
- 30-6. International Cong. of Agricultural and Food Industries, 10th, Madrid, Spain. (Sec., 3, Zurbane, Madrid.)

### June

- 7-12. International Cong. of Psychology, 14th, Montreal, Can. (H. S. Langfeld, Eno Hall, Princeton Univ., Princeton, N.J.)
- 9-12. American Soc. for Quality Control, 8th, St. Louis, Mo. (D. Shainin, 70 E. 45 St., New York.)
- 11-17. Pan American Assoc. of Ophthalmology, 3rd, São Paulo, Brazil. (M. E. Alvaro, Consolação 1151, São Paulo.)
- 14-16. American Soc. of Agronomy, Corn Belt Branch, annual, Lincoln, Neb. (E. J. Frolik, Dept. of Agronomy, Univ. of Nebraska, Lincoln 3.)
- 14-18. American Soc. for Engineering Education, annual, Urbana, Ill. (A. B. Bronwell, Northwestern Univ., Evanston, Ill.)
- 14-18. American Soc. for Testing Materials, annual, Chicago, Ill. (R. J. Painter, 1916 Race St., Philadelphia 3, Pa.)
- 14-18. Symposium on Molecular Structure and Spectroscopy, annual, Columbus, Ohio. (H. H. Nielsen, Dept. of Physics, Ohio State Univ., Columbus 10.)

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## Meetings & Conferences

June, contd.

- 14-19. Cong. and Exhibition of l'Aluminium Français and La Société Chimique de France, Paris, France. (R. Gadeau, 23 Rue Balzac, Paris 8.)
- 15-18. Medical Library Assoc., Washington, D.C. (Col. F. B. Rogers, Armed Forces Medical Library, Washington 25.)
- 16-19. Colloquium of College Physicists, annual, Iowa City, Iowa. (G. W. Stewart, Dept. of Physics, State Univ. of Iowa, Iowa City.)
- 18-19. American Rheumatism Assoc., annual, San Francisco, Calif. (W. H. Kammerer, 33 E. 61 St., New York 21.)
- 18-22. Canadian Medical Assoc., Vancouver, Can. (General Sec., 135 St. Clair Ave., West, Toronto 5.)
- 19-20. Soc. for Investigative Dermatology, San Francisco, Calif. (H. Beerman, 255 S. 17 St., Philadelphia 3, Pa.)
- 20-23. American Astronomical Soc., Ann Arbor, Mich. (C. M. Huffer, Washburn Observatory, Madison 6, Wis.)
- 20-23. American Soc. of Agricultural Engineers, annual, Minneapolis, Minn. (F. B. Lanham, ASAE, St. Joseph, Mich.)
- 20-24. American Soc. of Medical Technologists, Miami Beach, Fla. (R. Matthaui, Suite 25, Hermann Professional Bldg., Houston 25, Tex.)
- 20-26. American Inst. of Chemical Engineers, Ann Arbor, Mich. (D. L. Katz, Dept. of Chemical Engineering, Univ. of Michigan, Ann Arbor.)
- 20-26. American Soc. of Mechanical Engineers, semiannual, Pittsburgh, Pa. (C. E. Davies, 29 W. 39 St., New York.)
- 20-26. International Meeting on Chemical Engineering Aspects of Nuclear Processes, Ann Arbor, Mich. (D. L. Katz, Dept. of Chemical Engineering, Univ. of Michigan, Ann Arbor.)
- 20-26. American Library Assoc., annual, Minneapolis, Minn. (D. H. Clift, 50 E. Huron St., Chicago 11, Ill.)
- 20-10. National Training Laboratory in Group Development, Bethel, Me. (L. P. Bradford, 1201 16 St. NW, Washington 6, D.C.)
- 21-23. Chemical Inst. of Canada, 37th annual, Toronto, Can. (D. W. Emmerson, 18 Rideau St., Ottawa 2.)
- 21-24. Western Soc. of Naturalists, Pullman, Wash. (J. L. Mohr, Dept. of Zoology, Univ. of Southern California, Los Angeles.)
- 21-26. Alpha Chi Sigma Fraternity, annual, East Lansing, Mich. (J. R. Kuebler, 5503 E. Washington St., Indianapolis 19, Ind.)
- 21-26. American Inst. of Electrical Engineers, summer general and Pacific general, Los Angeles, Calif. (H. H. Henline, 33 W. 39 St., New York 18.)
- 21-26. Technical Writers' Inst., 2nd annual, Troy, N.Y. (J. R. Gould, Rensselaer Polytechnic Inst., Troy.)
- 21-26. American Medical Assoc., annual, San Francisco, Calif. (AMA Office, 535 N. Dearborn St., Chicago 10, Ill.)
- 22-24. American Dairy Science Assoc., 49th annual, State College, Pa. (J. O. Almquist, College of Agriculture, Pennsylvania State College, State College.)
- 22-26. Rubber Technology Conf., 3rd, London, Eng. (Sec., Institution of Rubber Industry, 12, Whitehall, London, SW 1.)
- 23-26. Cong. for the Advancement of Spectrographic Methods, 17th, Paris, France. (Sec., G.A.M.S., 1, Place St. Thomas d'Aquin, Paris 7.)

## Meetings & Conferences

June, *contd.*

- 23-26. Acoustical Soc. of America, 25th, New York, N.Y. (W. Waterfall, 57 E. 55 St., New York 22.)  
 25-29. Inst. of Aeronautical Sciences, New York, N.Y. (S. P. Johnston, 2 E. 64 St., New York.)  
 27-1. Inst. of Food Technologists, annual, Los Angeles, Calif. (C. S. Lawrence, 176 W. Adams St., Chicago 3, Ill.)  
 28-29. National Science Teachers Assoc., New York N.Y. (R. H. Carleton, 1201 16 St. NW, Washington 6, D.C.)  
 28-30. American Assoc. of Physics Teachers, Minneapolis, Minn. (R. F. Paton, Univ. of Illinois, Urbana.)  
 28-30. American Physical Soc., Minneapolis, Minn. (K. K. Darrow, Columbia Univ., New York 27.)  
 28-2. European Cong. of Gastroenterology, 4th, Paris, France. (A. Busson, 63 bis Rue de Varenne, Paris 7.)  
 28-3. National Education Assoc., annual, New York, N.Y. (L. W. Ashby, 1201 16 St. NW, Washington, D.C.)  
 30-2. Heat Transfer and Fluid Mechanics Inst., Berkeley, Calif. (H. A. Johnson, Dept. of Mechanical Engineering, Univ. of California, Berkeley.)

July

- 1-9. British Medical Assoc., Glasgow, Scotland. (BMA, Tavistock Square, London, WC 1.)  
 2-8. International Cong. of Oto-Neuro-Ophthalmology, 19th, São Paulo, Brazil. (C. de Rezende, Hospital das Clinicas, Avenida Ademar de Barros, São Paulo.)  
 2-14. International Cong. of Botany, 8th, Paris, France. (P. Chouard, 11, Rue de Val-de-Grace, Paris 5.)  
 6-9. American Home Economics Assoc., San Francisco, Calif. (Miss M. Horton, 1600 20 St. NW, Washington, D.C.)  
 6-9. International Conf. on Electron Microscopy, London, Eng. (F. W. Cuckow, Royal Cancer Hospital, London, SW 3.)  
 7-10. American Physical Soc., Seattle, Wash. (J. Kaplan, Univ. of California, Los Angeles.)  
 8-9. International Union of Pure and Applied Physics, 8th, London, Eng. (H. A. Barton, 57 E. 55 St., New York 22.)  
 10-15. Latin American Cong. on Gynecology and Obstetrics, 2nd, São Paulo, Brazil. (J. Ramos, Av. Brigadeiro Luiz Antonio, 278-80, São Paulo.)  
 15-17. Conf. on Defects in Crystalline Solids, Bristol, Eng. (H. A. Barton, 57 E. 55 St., New York 22.)  
 13-17. Cong. on Experimental and Theoretical Nuclear Physics, Glasgow, Scotland. (H. A. Barton, 57 E. 55 St., New York 22.)  
 15-17. International Symposium on Solid Particles in Astronomical Objects, Liège, Belgium. (P. Th. Oosterhoff, Leiden Observatory, Leiden, Netherlands.)  
 15-21. Pan American Cong. of Child Welfare and Pediatrics, 4th, São Paulo, Brazil. (J. Ramos, Av. Brigadeiro Luiz Antonio 278-80, São Paulo.)  
 17-22. Latin American Cong. on Mental Health, 1st, São Paulo, Brazil. (A. C. Pacheco e Silva, Av. Brigadeiro Luiz Antonio 278-80, São Paulo.)  
 19-23. International Cong. of Gerontology, 3rd, London and Oxford, Eng. (Mrs. A. Humpage, Tavistock Square, London, WC 1.)  
 19-24. Pan American Cong. on Gastroenterology, 5th, São Paulo, Brazil. (J. Ramos, Av. Brigadeiro Luiz Antonio 278-80, São Paulo.)

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- 21-28. International Cong. of Crystallography, 3rd, Paris, France. (J. D. H. Donnay, Johns Hopkins Univ., Baltimore, Md.)
- 23-29. International Cancer Cong., 6th, São Paulo, Brazil. (H. L. Stewart, National Cancer Inst., Bethesda, Md.)
- 25-31. Inter-American Cong. of Sanitary Engineering, 4th, São Paulo, Brazil. (L. Nogueira, Caixa Postal 8099, São Paulo.)
- 26-31. International Cong. of Gynecology and Obstetrics, Geneva, Switzerland. (W. Geisendorf, Maternité, Hôpital Cantonal, Geneva.)
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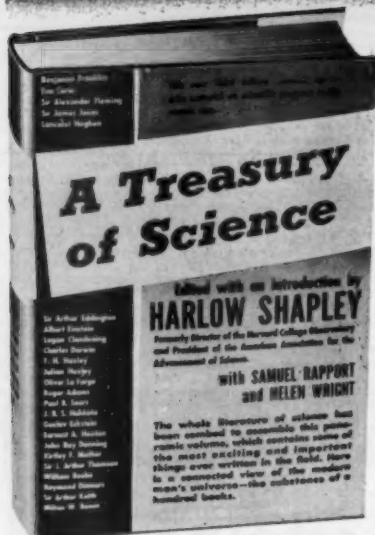
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- 10-14. Canadian Teachers' Federation, annual, Vancouver, Canada. (G. G. Croakery, 444 Mac Laren St., Ottawa.)
- 12-14. International Cong. on Group Psychotherapy, 1st, Toronto, Can. (J. L. Moreno, 101 Park Ave., New York 17.)
- 13-14. International Cong. on Child Psychiatry, Toronto, Can. (A. Z. Barhash, 186 Clinton Ave., Newark 5, N.J.)
- 13-21. World Poultry Cong., 10th, Edinburgh, Scotland. (Cong. Sec., Dept. of Agriculture for Scotland, St. Andrew's House, Edinburgh 1.)
- 14-21. International Cong. on Mental Health, 5th, Toronto, Can. (J. D. Griffin, 111 St. George St., Toronto 6.)
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